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CONTRIBUTIONS TO BOTANY,

ICONOGRAPHIC AND DESCRIPTIVE,

DETAILING

THE CHARACTERS OF PLANTS THAT ARE EITHER NEW
OR IMPERFECTLY DESCRIBED;

TO WHICH ARE ADDED

REMARKS ON THEIR AFFINITIES.

BY

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ACAD. CÆS. NAT. CUR. SOC.

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PREFACE.

The two volumes of 'Illustrations,' published some years ago, were confined almost exclusively to the description of South American plants. Several reasons induced me to extend the range of these investigations; and I now offer the first volume of 'Contributions to Botany,' wherein the productions of both hemispheres are described. While engaged in examining the plants I had collected abroad, belonging to the family of the *Olacaceæ*, I was surprised to find in its two tribes great incongruity, not only in their normal structure, but in their subsequent development,—a difference of constant occurrence, whether the plants were of Asiatic, African, or American origin, bearing evidence that the two tribes are really distant in their affinities. This led me to extend the investigation further than was at first intended, and to complete a Monograph of the whole of the second group, which I proposed should rank as a distinct order (the *Icacinaceæ*), and which should take its place near the *Aquifoliaceæ*. In pursuing this investigation, I was aware of the responsibility incurred, and was conscious that nothing short of the most palpable evidence could avail; for the *Icacineæ* had been associated with the *Olacineæ* by one of the most distinguished and accurate botanists of our time,—an association that had been accepted by all subsequent authors, and considered to be established. The investigation was therefore pursued with the utmost precision; and the evidence thus collected will be seen to occupy the earlier portion of this volume. In support of the conclusions then inferred, the analytical details are now added in the accompanying plates. Nearly ten years have intervened since the text here reprinted appeared successively in the 'Annals of Natural History,' and no one has attempted in this interval to disprove the truth of the facts then stated: hence my conclusions on this subject may be taken to be silently, if not formally acknowledged.

Subsequently I attempted, in the same manner, to show that a similar error had been committed in associating the *Symplocineæ* with the *Styracineæ,* two tribes constituting the order *Styraceæ* of DeCandolle. I was induced to extend this investigation by careful analyses of a great number of the species of both tribes, and was enabled to point out the very essential difference in the normal structure and subsequent development constant through both of them. This evidence demonstrates that the *Symplocineæ* should constitute a family (*Symplocaceæ*) distinct from *Styraceæ,* and should be placed in a distant position in the system. All the facts regarding the latter family, as they appeared originally in the 'Annals of Natural History,' are here again brought together, and rendered more obvious by analytical drawings: those relating to the *Symplocaceæ* will be published at a future time. This investigation likewise required the utmost care and precision, because it involved the necessity of opposing the authority of two eminent botanists. It is fair to remark that, after the lapse of some years, the validity of my conclusions has not been challenged.

The results of my subsequent investigations prove the importance of the object aimed at in my previous discussions respecting the nature of the outer seed-coats of the *Clusiaceæ,* and especially of the arilloid tunic of *Magnolia.* The reception which my views on this question met with only stimulated me to further exertion, and led to my observations, which will be found in this volume, on the early formation and subsequent mode of growth of the ovule,—an investigation undertaken to mark, by the development of the raphe, the tests by which the true integuments of seeds may always be distinguished from those of adventitious origin or of arilliform growth. The reasons that actuated me in the agitation of this question are manifested in the results of my inquiries into the nature of the seed-coats of the *Canellaceæ*, *Winteraceæ*, *Lardizabala*, and the *Rhamnaceæ*, which are here illustrated, and in my yet unpublished researches into those of the *Anacardiaceæ*. Although the aim of this inquiry has not been understood, and has been regarded by some botanists as of trivial importance, I feel persuaded that, ere long, these points of structural botany will command the attention they merit. By pointing out the fallacy of the doctrine of the so-called inversion of the anatropous ovule, I have endeavoured to remove the impediments that have led to great misconception regarding the early development of the ovule, and the changes it undergoes during its subsequent growth, in the production of the many kinds of tunics which form the coverings of seeds, and which in their nature have been strangely confounded together.

As the greater part of the text in this volume has been many years in type, it is necessary to explain the cause of the delay of the present publication: this has arisen from my inability to complete the plates. Several artists employed by me failed in delineating my drawings with even tolerable accuracy; and I have since been compelled to lithograph all the plates in this volume. The want of sufficient leisure to complete this task sooner must plead my excuse.

Hammersmith,
Nov. 1861.

CONTRIBUTIONS TO BOTANY.

Aptandra.

The last collection of Mr. Spruce from the neighbourhood of Obidos, on the river Amazon, contains among many very interesting plants one of very singular and anomalous structure. It is arborescent, with slender, smooth branchlets and somewhat copious foliage, its leaves being alternate, smooth and petioled, but without stipules. Its inflorescence is axillary, in long slender branching panicles, the flowers numerous and minute, each being supported upon a long filiform ebracteated pedicel. The calyx is a short fleshy cup, quite free, with four short teeth, and hence almost quadrate. The corolla consists of four fleshy, linear petals many times longer than the calyx, with their apex enlarged by a concave pointed expansion, valvate in æstivation, forming in bud a clavate head, surmounting a terete cylinder; this at first opens like four reflexed valves, showing the anthers, but they gradually separate to the base, becoming coiled and revolute, like the corolla of a *Hamamelis* or a *Chionanthus*. The stamens consist of a thick, fleshy, cylindrical tube, nearly the length of the corolla, which has a clavate globular head, exhibiting the anthers, arranged externally upon this, almost solid, fleshy, globular connective; this has a very narrow orifice, and is perforated down the middle for the style and stigma, which are closely embraced by it. The anther-cells, eight in number, and equal in size, are imbedded upon the external face of this connective, forming an annular ring, each cell opening extrorsely, by the separation of its external membranaceous valve, which remaining hinged at its base opens from top to bottom, and thus all become alike permanently reflected. The pollen is composed of white farinaceous granules, somewhat aggregated, and inclosed in the inner imbedded valves of the anther-cells; examined under a microscope every granule is singularly cruciform, each arm being terminated by a small rounded extremity, with a similar globular elevation in the centre. Four small, fleshy, very distinct and free hypogynous scales invest the base of the staminal tube, and intervene between it and the petals, with which they alternate; they have a rounded and subemarginated summit, are striately grooved and marked on both sides with lines of intermingling red spots. The ovarium is oblong, seated on a short stipitate support, is somewhat conical and compressed, with a groove along each flattened side, the style being continuous with its apex, and surmounted by a compressed, obtuse, oblong stigma, which is closely invested by the globular connective, so that it is difficult to extract it without breaking the style. The ovarium is unilocular at its summit and bilocular at the base, the incomplete dissepiment corresponding with the grooves; a single ovule is suspended in each cell from the summit of the flattened axile placenta, which is an extension of the half-dissepiment, and each ovule appears enveloped by a distinct membrane, which is marked on its dorsal face below the middle with short parallel lines of reddish dots; the lower part of the style, for the third of its length, is hollow, this vacuity being an extension of the unilocular space in the summit of the ovarium, showing distinctly that there exists no direct communication between the placenta and the style. The fruit is yet unknown, but the calyx evidently enlarges considerably, and the pedicel lengthens with the growth of the ovarium, as in *Heisteria*. These characters, of which the following is a diagnosis, evidently belong to no known genus: I therefore propose for it the name of *Aptandra*, from *ἅπτω*, *necto*, and *ἀνὴρ*, *mas*, on account of the very curious union of the stamens into a single organ.

APTANDRA (gen. nov.).—*Calyx* brevissimus, patelliformis, 4-sulcatus, 4-dentatus, carnosus, fructu augescens. *Petala* 4, æqualia, calycis lobis alterna, carnosula, lineari-lingulæformia, summo latiori concava, apiculo inflexo, æstivatione valvata, demum spiraliter reflexa. *Squamæ petaloideæ* 4, liberæ, crassæ, rotundatæ, petalis alternæ, inter eadem et tubum staminalem sitæ. *Stamen* integrum (forsan e quatuor staminibus coalitis, petalis exterioribus oppositis compositum), cylindraceum, longitudine corollæ, tubo tereti, carnoso, pistillum presse cingente; *antheræ* ex loculis 8, oblongis, æqualibus, arcte in annulum extrorsim dispositis et in connectivum fere globularem crasso-carnosum,

summo pervium immersis, singulatim valvula exteriori membranacea ab apice ad basin valvatim soluta, et hinc diutine omnino reflexa. *Pollen* subfarinaceum, cruciformi-lobatum, granulis amplis. *Ovarium* conico-oblongum, subcompressum, 2-sulcatum, imo biloculare, summo uniloculare, loculo cum cavo styli longe continuo; *ovula* in loculis solitaria, anatropa, obovata, apice placentæ centralis liberæ dissepimento adnatæ utrinque suspensa. *Stylus* filiformis, erectus, longitudine fere staminis, imo conicus et cavus. *Stigma* oblongum, compressum, obtusum, inclusum. *Fructus* ignotus.—Arbor *biorgyalis, Amazonicus, glaber*; folia *alterna, elliptica, penninervia, reticulata, petiolata, exstipulata*; inflorescentia *dichotome paniculata, axillaris, multiflora*; pedicelli *filiformes, subumbellatim aggregati, uniflori*; flores *minimi.*

1. *Aptandra Spruceana*;—foliis ellipticis, subreflexis, apice subito attenuatis, utrinque glabris, subtus punctis minutissimis lentiginosis et pellucidis notatis, rachi nervisque rubentibus; paniculis folio 3-plo brevioribus, pedicellis gracilibus, subfasciculatis, in fructu valde elongatis et crassioribus; bracteis linearibus e dichotomiis minutis et caducis.—Fluv. Amazonicus circa Obidos (Spruce)*.

I have little to add to the previous description, except that the leaves are about 1½ inch apart, 4½ inches long, 2¼ inches broad, on a reflexed petiole of ¼ inch in length; they are thin in texture, with the margin turned back, especially toward the base, somewhat polished above, dull and pale beneath. The inflorescence, about 2 inches long, throws out four or five lateral branches, which are again dichotomously divided, each branchlet having a number of very fine filiform pedicels almost umbellately fasciculated, about 3 or 4 lines long, which subsequently grow to the length of an inch, and probably much longer when the fruit is matured; the flowers are 1½ to 2 lines long, and ⅓ of a line in diameter before opening. I may here add an observation relative to the stamen, which has eight equal anther-cells: now as the calyx, corolla and petaloid scales are all 4-merous, it is to be presumed that this staminal organ is composed of four united stamens, each with two anther-cells, placed opposite to the petals, and alternate with the intervening petaloid scales and the teeth of the calyx; and this is further proved by the fact, that no one anther-cell is exactly opposite to or alternate with the petals, but two cells are situated before each petal.

From the foregoing details it will be seen that the exact posi-

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* A representation of this plant, with generic details, will be given in plate 1.

tion of *Aptandra* in the system is not easily determinable. At first view, from the very peculiar structure of the stamens, it seems to approach *Cissampelos*, but independently of other circumstances, one fact, that of a simple biovular ovarium, at once excludes it from the *Menispermaceæ*.

The several families included in the *Columniferæ* of Endlicher, viz. *Sterculiaceæ*, *Büttneriaceæ*, &c., present the analogy of their filaments being more or less coherent at base into a hypogynous tube; but there, a portion of the filaments is always free, as are also the anthers, which are very differently constructed, besides which, the ovarium consists of numerous carpels, united round a central axis, upon which ovules more or less numerous are attached by their ventral face; there also, for the most part, the corolla has a torsive or imbricated æstivation, and in their general habit they do not agree.

In like manner, the *Meliaceæ* present stamens, formed of a cylindrical tube, but this is many-toothed at its apex, and the 2-celled anthers, double the number of the petals, are quite distinct, affixed within the mouth of the tube, and burst introrsely by longitudinal fissures. They have also a free calyx, but its segments are distinct and imbricated. The corolla consists of four or five petals, sometimes valvate in æstivation, though often imbricated, but they have no indication of any such petaloid scales as are seen in *Aptandra*. The ovarium is frequently stipitate, but most generally is imbedded at base in a fleshy cup; it is plurilocular, with two or more ovules in each cell. The style is simple and the stigma clavate. Here are therefore some few points of resemblance, while others are again at variance with *Aptandra*, the general habit of which does not at all conform with the *Meliaceæ*, which, for the most part, have pinnated or bipinnated, and often dentated leaves.

In the *Humiriaceæ* we do not find any satisfactory analogies, for although the stamens there are partly monadelphous, or rather polyadelphous at base, and the anthers have a large fleshy connective, there is nothing approximative in the structure of these organs to what we find in *Aptandra*. The calyx consists of distinct sepals, which are decidedly imbricate, and the petals have a twisted, imbricated, and almost convolute æstivation: the nectary is tubular, investing the base of the ovarium, is thin and membranaceous, and is interior with respect to the staminal tube, and bears no analogy with the petaloid scales of the genus under consideration. The ovarium is 5-celled, with two superimposed ovules in each cell, attached to a central point of an axile column, which point enlarges to form a transverse spurious dissepiment across each cell; and finally, their leaves are very thick and coriaceous.

The *Hamamelidaceæ* offer several strong points of resemblance, more especially in having four linear petals, which, when expanded, are in like manner spirally revolute; the anthers sometimes open by deciduous valves, they have an ovarium with two suspended ovules, and they possess also four hypogynous scales. But the ovarium is bilocular, and is decidedly adnate to the tube of the calyx, so that it is two-thirds inferior; the calycine segments are large in proportion; the æstivation of the corolla is torsively imbricate; the ovules are in most cases several in each cell, although only one is generally matured, or when single they are suspended from the apex: there are two distinct styles; the hypogynous scales are not exterior to the stamens, but alternate with them, forming one common whorl; the anthers are introrse and somewhat 4-celled, and their mode of dehiscence, although sometimes valvular, is very different, and finally the leaves are furnished with stipules.

In *Bruniaceæ* we meet with extrorse stamens, but they offer few other points of analogy; the ovarium is there inferior, and they have quite a different habit.

The *Alangiaceæ* present some few points of resemblance, in the form and æstivation of their corolla, in the union of the anthers into a tube, and in their ovarium with two suspended ovules; but the calyx is wholly adnate with the ovarium, the filaments are free, the introrse anthers burst by longitudinal slits, and the ovarium is distinctly bilocular.

The *Oleaceæ*, especially *Chionanthus, Linociera,* and *Tessarandra,* offer some degree of similitude, in the form of the calyx and corolla, but their ovarium is bilocular, the ovules are placed collaterally in pairs in each cell, the stamens are few and free, they want the petaloid scales, and finally they have opposite leaves.

Leonia presents stamens with the filaments united at base, but the tube thus formed is adnate upon a gamopetalous corolla, and the structure of the anthers is wholly different.

The same objections may be offered to the *Styraceæ,* although they have often extrorse stamens.

The anomalous genus *Diclidanthera* has its anthers furnished with reflexed valves, which, as in *Aptandra,* open from the top to the bottom; but they are introrse, and by the adhesion of the filaments to the petals, appear sessile in the mouth of a gamopetalous corolla, and it offers otherwise few analogies.

There are some points of accordance in the *Sauvagesiaceæ,* in their internal row of petaloid scales, sometimes combined into a tube, and in having the stamens opposite to the petals. The anthers are extrorse, and even confluent into an incomplete tube in *Luxembergia*; there exists also some analogy in their ovarium being 3-celled at base and unilocular at summit, but they differ in their imbricated calyx and corolla, distinct stamens, the parietal placentation of the ovarium, and their remarkably stipulate leaves. *Luxembergia* however is placed by M. Planchon, with much reason, among the *Ochnaceæ*.

The *Olacaceæ* present many strong points of resemblance; for we have there, as in the genus under consideration, a small calyx with minute teeth, equal in number to the petals, which are generally four in number, often linear, of thickened texture, and valvate in æstivation; they have also free appendages of various forms alternating with the stamens; these last-mentioned organs are frequently monadelphous at base; they have an ovarium wholly superior in regard to the external calyx, often stipitate, and sometimes presenting two suspended ovules; the inflorescence accords, and the pedicels have deciduous bracts at their base; and the leaves are alternate with similar venation. Added to these, it appears that in *Aptandra* the pedicel lengthens and the calyx enlarges with the growth of the ovarium after impregnation, as in *Heisteria*, and the resemblance in size and shape of its flowers to those of *Gomphandra* is very remarkable. But on the other hand, in *Olacaceæ*, the appendages are evidently sterile stamens, and in no degree partake of the nature and position of the petaloid scales of *Aptandra*; the stamens are very differently constructed, the filaments are always separated from each other, often indeed more or less slightly agglutinated to the corolla, the bilobed anthers are distinct and introrse, and never open by reflected valves, and the structure of the pollen is very different; the fully developed disk, that generally forms so striking a feature in that family, is also wanting in *Aptandra*. In *Olacaceæ* we find the flowers generally issuing from bracteated, imbricated buds, but in *Aptandra* we see nothing of this kind. In the internal structure of the ovarium of this genus a considerable difference is there seen from that existing in most of the genera of the *Olacaceæ*. In the former the pericarpial covering is so very thin and transparent, that by transmitted light its internal structure may easily be distinguished, and the vacuity in the conical base of the style is thus seen to be continuous with the cell of the ovarium, in the upper part of which the apex of the placenta is there seen to be quite free. In most of the genera of the *Olacaceæ* the ovarium is half enveloped by, and is partially adnate to a fleshy cup-shaped disk, which rises to half the height of the ovarium, and which supports the stamens and corolla, while the upper moiety of the ovarium is surmounted by a very thick fleshy gland; but no trace of any such hypogynous disk or epigynous gland is visible in *Aptandra*. In the internal structure of the ovarium it presents however one of the strongest points of approach to the *Olacaceæ,* but it must be remembered that such a structure is not peculiar to that family, for it is found to exist equally in the *Santalaceæ, Styraceæ* (excluding of course *Symplocaceæ*), *Ebenaceæ, Myrsinaceæ,* and *Theophrastaceæ.* We must therefore look to this general character of an unilocular ovarium, with a central placenta wholly distinct from the style, and more or less free or combined with spurious dissepiments, as belonging to a class composed of several orders, just as we unite into groups or classes, numerous other families, possessed of a bilocular or plurilocular ovarium, and others again that are unilocular with parietal placentations; and it does not follow, that we must associate other plants in *Olacaceæ,* merely because they have an ovarium constructed in a somewhat similar manner. The existence of an inner whorl of petals, the union of the stamens into a thick columnar tube, the anthers imbedded extrorsely in an annular and almost globular fleshy connective, the peculiar mode of the dehiscence of the anther-valves, the curious structure of the pollen, the absence of the deep hypogynous disk and of the thick epigynous gland, are points quite at variance with all we find in the *Olacaceæ,* where we meet with nothing in the smallest degree analogous to the very peculiar features that mark *Aptandra.* However striking its points of approach, it is evident that this genus cannot be referred to that family, although its position in the system may be proximate.

There is yet another group of plants offering some features of resemblance, to which it is worth while to direct our attention; I mean the *Canellaceæ* of Von Martius, the characters and real affinities of which are yet too imperfectly understood. It consists of three genera, all with their stamens united into a tube, as in *Aptandra,* and with extrorse anthers, although the cells are said to open longitudinally, but they vary greatly in their other characters, and evidently belong to three several families. *Platonia* is clearly referable to the *Guttiferæ,* with which it agrees in having opposite leaves; *Canella* probably has a considerable affinity with the *Humiriaceæ*; and *Cinnamodendron* (the *Canella axillaris,* Mart. Nov. Act. 12. tab. 3) may perhaps be found to be allied to *Aptandra,* for besides its synantherous stamens, it has a similar whorl of petaloid scales intervening between the staminal tube and the petals.

Hornshuckia has also a small truncated calyx, a corolla of six petals in two series, the inner smaller and carinated, extrorse stamens, and a 3-locular (?) ovarium, with a single ovule in each cell.

Much will depend upon the structure of the fruit and seed before any final decision can be made in regard to the nearest affinities of *Aptandra,* but taking the above-mentioned facts into consideration, we may draw the legitimate inference, that if, from its indubitably peculiar characters, it be considered as the type of a yet unknown group of plants (*Aptandraceæ*), it may probably find its station, in the arrangement of Endlicher, following the *Berberidaceæ*, taking its rank among that portion of the polypetalous *Thalamifloræ*, with the segments of the corolla often in more than one series, and with an ovarium composed of two or more united carpels, and with one or few ovules attached to a placenta of somewhat gynophorous origin. It would thus stand at no great distance from the *Menispermaceæ*, which it resembles in its synantherous stamens with extrorse anthers and scale-like inner row of petals; not very far from the *Anonaceæ*, because of their 2-seried petals, with valvate æstivation and extrorse stamens; and near the *Berberidaceæ*, on account of their corolla in two series, of the valve-like dehiscence of their anthers, which are also extrorse, their stipitate ovarium, entire style and stigma, and the structure of the seed and embryo.

In this same projected division, it appears to me, some other groups will before long find their place, and will thus mark a better gradation, and form a more complete link between the *Polycarpicæ* of Endlicher and those syncarpous orders with simple series of floral envelopes, which now exhibit too wide a space of transition between them. These will probably form a distinct class (*Cionospermæ* from the development of the ovules on a central and more or less columnar placenta) intermediate between the *Polycarpicæ* and *Rhœades*, and into it will enter more naturally the *Berberidaceæ*, which in truth are never polycarpic, for they have generally a solitary unilocular ovarium, with the placentæ either central or by partial suppression, adhering parietally to the sides of the cell. We may consider this alliance as presenting a development of one or more carpellary leaves, with the sterile margins often somewhat partially introflexed, so as to form spurious dissepiments, and the ovuliferous placentæ emanating from their basal or hypothetically petiolar supports, and united in a basal or columnar trophosperm. In this respect, it will be seen to be an intermediate stage of development between the *Polycarpicæ* and the *Rhœades*, in which last class the margins of the carpellary leaves are placentiferous, and there simply united together, and being elevated on their petiolar supports, thus form a distinct gynophorus: they offer some analogy with the Gynobasic classes, which at the same time exhibit a gynophorous origin, with the axile union of the introflexed placentary margins of the carpels. In the class I have here suggested, the *Olacaceæ*, *Styraceæ*, *Ebenaceæ*, *Myrsinaceæ*, &c. may probably find a better position than the stations assigned to them in most of the modern systems of arrangement, and I shall take an early opportunity of demonstrating the facts, and offering the reasons, upon which such an opinion is grounded, as I propose soon to publish the description of several curious genera belonging to the *Olacaceæ, Styraceæ,* &c.

CATHEDRA.

This is a very singular genus, which I proposed a few years ago, for an arborescent shrub that I found near Rio de Janeiro, having much the appearance of a *Myrsine,* with which genus its flower agrees, in having a small cupshaped calyx, as many stamens as petals placed opposite to them, a short style and a clavate stigma, a depressed ovarium, which is unilocular, with seeds fixed to a central placenta. It differs however from that genus, in its almost entire calyx, in its petals and stamens being six in number, inserted upon the margin of a fleshy hemispherical or cupuliform disk, which is quite free both from the calyx and the ovarium, and in its remarkably thick fleshy petals with a tuft of long stiff hairs in the centre, and which are quite valvate in æstivation, whereas in *Myrsine* they are thin in texture, and in æstivation are always more or less imbricated. M. A. DeCandolle, in his 'Prodromus,' viii. p. 93, states, however, that they are valvate in *M. variabilis* and *M. Paulensis,* contrary to the usual structure of the genus; but I find in the latter species, as also in *M. Rapanea,* and I believe in all the Brazilian genera, that the constantly thin margins of the petals always slightly overlap each other, especially towards the apex: I was at one time, in like manner, mistaken on this point, but on examining the buds with more attention, I satisfied myself in regard to the fact in question.

The somewhat bilobed tetragonous anthers in *Cathedra* consist of four cells quadrately placed around a central connective, and formed of thick crystalline walls, composed of numerous long transverse cellules or hollow cylinders, closed at both ends, forming a honeycombed texture, and which are all arranged in a radiating series around each of the four pollen-cells, so that the external surface of the anther is thus reticulated or rather bullated with the small hexagonoid convexities of the ends of the cellules. Hence, at first sight, there does not appear any provision for the escape of the pollen, but there may be perceived at length in the summit, four small circular depressions or spots, corresponding with the apex of the pollen-cells, which are not open pores, but appear cancellated, as if the ends of the cellules, forming their covering, had there become dissolved, leaving a sieve-like screen over the cells, through the meshes of which, it may be inferred, that the fertilizing particles escape by a kind of endosmose, and are conveyed by the villous tuft of long hairs belonging to the petals, and that overhang the anthers, to the stigma, which they embrace. I have examined at least 200 or 300 anthers, invariably with the same result, even after they have fallen away with the petals, and that they were not sterile is proved by the anther-cells being filled with perfect pollen-grains. I have remarked that the cellules of the anther-casing, when broken under water, exude an oily substance, and it is probable that this may find its way into the pollen-cells and assist in the escape of the fertilizing particles in the manner I have just described. After each anther has discharged its pollen, the walls collapse upon the vacant spaces, and it then assumes the appearance of being 2-lobed, and as if each lobe had burst by a longitudinal line of dehiscence; but if the whole anther in this state be cut across and moistened, it will resume its original shape and display the four separate empty cells in a very distinct manner. Much analogy will be found to exist in this structure to that of the anthers of *Choretrum*; these are stated by Mr. Brown (Prodr. p. 354) to be 4-locular and 4-valved, but although correct to a certain extent, this requires some explanation: their form, which is somewhat peculiar, is tolerably well represented in Endlicher's 'Iconographia,' tab. 45; the four rounded lobes there shown consist of four distinct pollen-cells, quadrately placed at right angles to the filament, round a short central connective, and inclosed by thick crystalline walls, as in *Cathedra*: but here, the apices of the cells, which point towards the style, at first open by a minute pore, close to the apical summit of the connective, when by the gradual contraction of the walls, the margins, beginning at these pores, recede and separate from it, showing a somewhat cruciform opening in the summit, and leaving the connective in the central space like a short columnar receptacle, around which the pollen-grains of the four cells remain agglutinated: there exist in reality no sutural slits, so that the anther can hardly be said to be 4-valved.

I have endeavoured to detect some similar mode of dehiscence in the anthers of *Cathedra*, which possess precisely the same structure, but in vain; although we might expect to find them discharge their pollen, as those of *Choretrum* are found to do. It may be well here to adduce the very analogous instance of similar structure in *Myzodendron*, which will be touched upon at greater length on some future occasion, and which has been very beautifully demonstrated by Dr. Hooker in his admirable analytical details of that genus in plates 104 and 105 of the 'Flora Antarctica'; in a subsequent memoir I shall compare the curious analogies observable in these instances, as they will be found to offer a strong bearing upon the affinities of *Cathedra*.

The anthers of *Viscum* will also serve to throw some light upon this subject; these have been clearly described by botanists as being formed of numerous, aggregated and distinct cells, each filled with pollen-grains, and which discharge these fertilizing particles by as many distinct pores, in a manner that has been described and clearly delineated by Richard in the 'Ann. Mus.' xii. p. 296. tab. 27. fig. 3. M. DeCaisne, in a learned memoir on the development of the pollen in *Viscum album* (Mém. Acad. Bruxelles, vol. xiii.), details the mode of growth of its anthers, and exhibits highly magnified transverse sections of the same in their different stages, but does not give a single vertical section, nor any description or drawing of the anther in its mature state: we may therefore conclude that he coincided with the description of Richard, in regard to its being composed of an indefinite number of distinct aggregated pollen-cells; he seems indeed to confirm this structure, for in his memoir just quoted, tab. 1. fig. 3, he shows a transverse section of an anther advancing to maturity, where nine such cells radiate upon its inner face, and in fig. 4 he gives a section of one of these distinct cells filled with pollen-grains. Endlicher repeats the same view of the structure of the anthers in *Viscum*, as being "multicellulosæ, poris plurimis dehiscentes." Prof. Lindley confirms the same statement (Veg. Kingd. p. 790), where he says, "in the genus *Viscum* the anther forms its pollen in a number of distinct cells, as in *Ægiceras*, this being beautifully illustrated by DeCaisne" (Mém. Acad. Brux. *loc. cit.*). Not having any opportunity of examining the structure of the anthers in *Viscum album*, I will not attempt to deny the facts vouched for upon such authority, but I can speak with confidence to what I have unquestionably observed in regard to their structure in dried specimens in all the Brazilian species of *Viscum* that I have examined. Here they are constantly free and sessile upon the base of the lobes of the perigonium, and on the margin of an adnate cupuliform disk; they are bilocular, the cells being parallel and of the whole length of the anther; these cells are filled with numerous pollen-grains, and are formed of very thick crystalline walls, consisting of large cellules, radiating around each central pollen-cell, as in *Cathedra*; and these cellules are closed at both ends by the external and internal facings of the walls, which are thin and marked with close-set parallel interrupted lines, as are also the lateral divisions between these cellules. On a future occasion I shall be able to show that other differences exist in the structure of the seed, in the tropical species of *Viscum*, which are not less striking than the fact here recorded respecting the conformation of the stamens. In my examination, I have not been able to perceive in any instance, an indication of the bursting of these two cells for the escape of the pollen, but at the apex the spaces over the cells become depressed, and may be mistaken for two open pores, which are also covered by a network screen, as before described, in the anthers of *Cathedra*. I have met with several other cases of somewhat similar structure in many genera of the *Santalaceæ*, and in some instances also in *Olacaceæ*, where however a form of anther prevails, which, though somewhat analogous, must not be confounded with the structure above described. Here the anthers are distinctly 4-lobed, 4-celled and 4-valved, often more or less crustaceous in texture, the cells opening alternately right and left by the evolution of the valves, which separate from the connective longitudinally by one of their margins, so that when these are rolled back the pollen is discharged, and they appear as if the anthers had been 2-celled and 4-valved, according to the usual mode of construction. The same development often occurs in *Loranthaceæ* proper, in *Rhamnaceæ*, *Celastraceæ*, and other families, although they are generally considered to have bilocular anthers; in these instances the valves are much thinner and reticulated in texture; they are the same in *Psittacanthus*; but in *Struthanthus*, though the walls are crystalline, and as thick as in *Cathedra*, they yet open in the manner just described.

The comparison of the characters of *Cathedra* with other genera has led me into a general examination of the *Olacaceæ*, *Santalaceæ*, and other allied families, in the course of which I have met with numerous interesting and novel facts, and from the materials thus collected, I propose to give at an early period, a review of each genus belonging to these orders in succession, together with illustrated details of their characters. In the following memoir on *Liriosma*, I will offer some of the views I have in consequence been led to adopt regarding the affinities of the families above alluded to.

The singular development of the very remarkable free cupuliform disk in *Cathedra*, that supports on its margin the petals and stamens, is an important feature, as it serves clearly to demonstrate the true nature of the same organ, which, with few exceptions, in all true *Olacaceæ*, is always more or less adnate with the ovarium and quite free from the calyx, but which in the genus *Liriosma* is connate with the calyx and wholly free from the ovarium; while in those genera of the *Santalaceæ*, where the calyx and corolla are confluent in one common perigonium, the disk is almost wholly coadnate with the latter: to this feature therefore, as it is developed in *Cathedra*, frequent recurrence will be made when we come to consider the different genera in the manner I have proposed. The ovarium in the plant under consideration is turbinate and flattened, the lower moiety being smooth and concealed within the free surrounding cup just mentioned, the upper moiety being covered with a thick fleshy gland, in shape like a very depressed cone, marked with twelve raised radiating striæ; it is 2-celled at base, unilocular at its summit, with a single ovule in each incomplete cell, suspended from the apex of the free axile placenta. This structure is quite analogous to that found in many genera of the *Olacaceæ*, and different from what exists in *Myrsinaceæ*. I regret very much that I did not meet with the ovarium further advanced towards maturity, but this deficiency is in some degree supplied by another very similar plant, evidently congeneric with the above, and to which our attention was called nearly eight years ago by Mr. Bentham (Lond. Journ. Bot. ii. 375), who says, " No. 5380 *bis*, of Gardner, from a single straggling shrub, found in a forest at Tejuca, fourteen miles from Rio de Janeiro, is a very singular plant, apparently allied to *Olacaceæ*, but unfortunately past flower in the specimens found. It has the habit, foliage, and inflorescence of a *Heisteria*. My specimens bear ovaries in different states of development after the fall of the corolla. They are fleshy and pulvinate, 1-celled inside, with one ovule pendulous from a lateral placenta. The calyx is persistent, very small, and bluntly 6-lobed, or rather with three emarginate lobes; between the calyx and ovary are three cup-shaped truncated disks one within the other. The outer one, considerably larger than the calyx, appears to increase gradually as the ovary swells; within it, the second disk, larger than the first, grows more rapidly; close around the ovary the third or innermost disk is quite short and concealed within the second, and does not increase at all. The ovary is very obtuse and crowned with the remains of a filiform style, from the base of which may be traced six diverging lines." I have examined a specimen of this plant in Sir Wm. Hooker's herbarium, and can confirm the accuracy of Mr. Bentham's observations, but with this difference, that the ovary is probably still more advanced, being of an oval form, and it is partly surrounded by four very distinct cup-shaped disks, that is to say, one more than was observed in Mr. Bentham's specimen. I annex a drawing and section of the ovary and concentric disks thus observed, to the plate which is here given of the analysis of *Cathedra rubricaulis*, and I have added a specific character of Gardner's plant. The smaller and innermost cup around the base of the ovary is evidently the same disk that supports the petals and stamens in my plant: this in the other species is inclosed in, and concealed by the second cup, which is double its length, and half the length of the ovary thus far grown, and is no doubt the true calyx; the other two outer cups, as well as the calyx, are each supported by a short stipes, and are successively smaller, the outermost being extremely short

and irregular on the margin. I can only account for the existence of these two outer cups, by supposing them to be merely external involucrating cupuliform bracts, now made manifest by the lengthening of the pedicel, and that have become enlarged in the same manner as the calyx, and which have formed part of the original gemma, out of which the clustered fascicle of almost sessile flowers springs; for in my flowering specimens, although these bracts are very short and almost obsolete, they are yet distinctly cupuliform. I have formed the generic name from *καθέδρα, sella,* on account of the petals and stamens being supported on the margin of an elevated cupuliform disk.

Cathedra (gen. nov.).—*Calyx* cupuliformis, carnosus, margine membranaceo-ciliatus, obsolete 6-dentatus, liber, persistens. *Petala* 6, oblonga, acuta, intus ad apicem subtrigona, carnosa, et glandulis brevibus sub-piliformibus creberrimis tecta, ad medium fasciculo setarum barbata, et ad imum subcompressa, truncata et simul cum staminibus puncto ad marginem disci singulatim inserta, erecta, æstivatione valvata. *Stamina* 6, petalis opposita, et iis dimidio breviora; *filamenta* brevissima, lata, crassiuscula; *antheræ* apicifixæ, subconicæ, subtetragoneæ, subgibbæ, imo cordatæ, apice mucrone obtuso signatæ, 4-loculares (summo poris 4 tegmine subdeliquescente hinc clathrato pro emissione pollinis vix apertæ?), areolato-crystallinæ, e cellulis elongatis circa loculos transversim radiantibus formatæ, facie externa hinc reticulato-bullatæ. *Pollen* ovatum, cancellato-reticulatum. *Discus* hypogynus, cupuliformis, carnosus, integer, calycis longitudine, utrinque omnino liber. *Ovarium* liberum, substipitatum, dimidio inferiori obconico glabro, dimidio superiori glandula carnosa depresso-conica radiis 12 notata pilosula coronato; imo 2-loculare, summo 1-loculare, 2-ovulatum, *ovulo* anatropo in loculum singulum incompletum apice placentæ axillaris utrinque pendulo. *Stylus* brevis, erectus. *Stigma* oblongum, obcordato-conicum. *Fructus* ignotus.—Arbusculus *Brasiliensis,* ramulis *subflexuosis,* cortice *rimoso, rubente*; folia *alterna, elliptica, coriacea, breviter petiolata, exstipulata*; flores *plurimi, parvi, e gemma axillari imbricati, aggregati, fere sessiles, glanduloso-tomentosi.*

1. *Cathedra rubricaulis*;—ramis nodosis, subflexuosis, rugosis, ramulis cortice rubro nitido rimoso deciduo vestitis; foliis lanceolato-oblongis, acuminatis, coriaceis, divaricatis, utrinque glaberrimis, subtus pallidioribus, margine revoluto, petiolo subbrevi, crassiusculo, canaliculato; fasciculo axillari, 10–12-flori, floribus creberrime aggregatis.—Rio de Janeiro ad montem Corcovado, *v. v.*

This is a small tree, about 12 feet high, with copious foliage, which I found growing near the aqueduct, at a spot called Agoas Novas, on the ascent of the Corcovado, in July 1837, and of which I made an analysis from living specimens. The bark of the younger branches is of a dark red colour, soon cracks and peels off, leaving the surface somewhat rugous and tubercled. Its leaves are alternate, with internodes half an inch apart; they are $3\frac{1}{2}$ to $4\frac{1}{2}$ inches long, $1\frac{1}{8}$ to $1\frac{1}{2}$ inch broad, upon a thick channeled petiole, 3 or 4 lines in length; they are polished above, dull, and of an apple-green colour beneath. The small cluster of flowers, densely aggregated in each axil, is scarcely half the length of the petiole; they spring successively out of a closely imbricated bud; the bracts, calyx, and corolla are covered with minute glandular subresinous clavate spicula, harsher and shorter than hairs, the two former of a reddish colour, the latter externally grayish. Each flower is about $\frac{1}{10}$th of an inch in length; the calyx is cup-shaped, fleshy at base, the margin being submembranaceous, ciliated, and obsoletely 6-toothed; the petals are very fleshy, oblong, truncated, and compressed at base, acute at summit, where they are much thickened internally, so as to be almost trigonous, and where the surface is covered with close short glandular reddish resinous clavate hairs; about the middle arises a tuft of long white hairs, which overshadow the summit of the anthers and embrace the stigma; when open, they are erect and scarcely thrown back. The stamens are one-third the length of the petals, the filaments being one-sixth the length of the anthers and equal to them in breadth; they are affixed by a small point at their base to the foot of the petals, and both attached by this common point to the outer margin of the cupuliform disk: the anthers from their gibbous form lean forward, and are connivent around the style; the structure of the anthers has been sufficiently described. The cupuliform disk is quite smooth, and is supported on a very short stipes within the more external cup-shaped calyx, to which it is equal in depth; its margin is thin, somewhat undulating about the points of insertion of the stamens, and fleshy towards the base; the ovarium is in the form of a very depressed cone, somewhat attenuated at the base, where it terminates in a short stipitate support; below it is quite smooth, but it is surmounted by a broad thick fleshy gland, slightly conical, marked with twelve raised striæ, radiating from the base of the style to the margin of the overlapping crenated border, which is encircled by the more elevated margin of the cupuliform disk; the rays and style are covered with grayish resinous globules or papillæ, like those seen on the external face of the petals. The internal structure of the ovarium has been already described *.

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* This species, with ample generic details, is shown in plate 2.

2. *Cathedra Gardneriana*, n. sp.; ramis nodosis, subflexuosis; foliis oblongis, glaberrimis, supra subnitidis, subtus pallidioribus, petiolo tenuiori; floribus in axillis paucioribus.—Tejuca, prope Rio de Janeiro. Gardner, no. 5380 *bis*.—*v. s. in herb. Hooker*.

This plant, referred to in the preceding page as described by Mr. Bentham, is distinct from the foregoing species, but the specimen in Sir Wm. Hooker's herbarium is not in good condition, being almost bare of leaves, only two or three of which are remaining; these are smaller than in my plant, are not spreading and deflected, are not coriaceous, and they grow black in drying; they are 2¾ inches long, and 1 inch broad, upon a petiole 3 lines in length*.

LIRIOSMA.

This genus, proposed by Pöppig, and figured in his 'Nov. Gen.' tab. 239, for a species found by him near the Rio Negro, in Brazilian Guiana, is yet but imperfectly known: its characters there given are in many respects incorrect or incomplete. That botanist referred it to *Olacaceæ*, it having been at first placed in *Styraceæ* by Endlicher. Two other species were soon afterwards announced, for which another new genus, under the name of *Hypocarpus*, was proposed by Prof. A. DeCandolle, in his 'Prodr.' viii. 245, which he considered to be more related to *Styraceæ*; but he was soon undeceived, as in the addenda to the same volume, p. 673, he recognised its identity with *Liriosma*. From a plant which I found near Rio de Janeiro in 1830, and which I then examined, I am enabled to complete the generic character, as far as regards the details of the fruit and seed, and at the same time, I now add my analysis of the floral structure of *L. Gardneriana*. Both Pöppig and DeCandolle describe the ovarium in this genus to be half imbedded in the adhering calyx; I find on the contrary that although the lower moiety of the ovarium is glabrous, and closely invested by the fleshy cup of the calyx, it is yet perfectly free from it, even for a considerable period after the fall of the corolla; the ovarium now increases more than the calyx, but at length the latter assumes the greatest increment, and at last wholly incloses it, becoming agglutinated with it, and converted into an enveloping pulp, leaving a small umbilical hollow in the summit and showing there the remains of its epigynous gland. The presence of a fleshy epigynous gland upon an inferior ovarium is a circumstance of the most ordinary occurrence, where it is held to be an abortive whorl of stamens; its existence upon a perfectly superior ovarium was therefore considered to be an impossibility, or when noticed it was always described as a mere basal enlargement of the style; but I have shown that in *Hyoscyamus* this anomaly really exists, and have since met with the same occurrence in several other instances. In the present case, its development is most decidedly marked, under the form of a prominent, rounded, fleshy disk, distinct in colour and texture, and exterior to the true pericarpial membranes. It is still more prominent in *Schöpfia,* and is found with a greater or less degree of development in most of the genera of the *Olacaceæ* and *Santalaceæ.* The internal structure of the ovarium accords with the character pointed out by Mr. Bentham, as a prominent feature of one of his tribes of the *Olacaceæ,* where its central placentation divides at its base into pseudo-dissepiments, leaving the summit of the internal space always free and unilocular, and the ovules suspended in that free space from the common apex of these incomplete divisions. This structure is decidedly marked in *Liriosma,* where the ovarium is 3-locular at base, with one ovule in each half-cell, suspended from the internal angle of these incomplete divisions, and here the apices of the ovules, rising above the points of suspension, are seen connivent in the perfectly unilocular summit of the ovarium. Of these ovules, as in the *Olacaceæ* and *Santalaceæ,* only one is perfected in the fruit, which becomes an oval crimson-coloured drupe, containing a putamen covered by pulp and inclosing a single albuminous kernel that fills its cavity; this exhibits externally a distinct raphe-like thread, extending from the base to the summit, as if the seed were suspended by a funicular support; but it will be seen that this thread partakes in no degree of the character of a true raphe, but is merely the remains of the pseudo-dissepiments, extended with the growth of the seed, and forced into a groove formed by pressure along its sides, there being seen at its summit a small cruciform extremity, resulting from the abortive ovules, similar to the structure that forms so remarkable a character of the *Santalaceæ,* as first pointed out by Mr. Robert Brown. This same appearance is well defined, and a true explanation of its origin is given by Mr. Bentham, in his excellent memoir upon the *Olacaceæ,* in the 18th volume of the 'Linnæan Transactions': he had observed the same structure in the genera *Olax, Heisteria* and *Schöpfia,* but its true nature had been mistaken by other botanists. The development of the seed in *Liriosma* is therefore identical with that of *Schöpfia,* a genus referred by Mr. Brown to *Santalaceæ,* but which Mr. Bentham first placed among the *Olacaceæ* with great reason; and this proves that the views of the former, in regard to the close affinity existing between these families, are founded upon truth, and I will presently adduce other proofs of their validity. The stamens,

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* A drawing of the ovarium and its section, with the surrounding cup-shaped bracts, is also given in plate 2.

both fertile and sterile, in *Liriosma,* in form and structure resemble those of *Olax*: and *L. Gardneriana* and the typical species have their three fertile stamens placed in an alternate position, between each second petal and their six sterile stamens, intermediate between them, which are of course placed opposite the six petals. With the exact number and position of the stamens in the other species we are not informed, but I believe that in this genus, as in *Olax,* the real normal number of petals is six, with six fertile and six sterile stamens, the former being always alternate with, the latter opposite to, the segments of the corolla.

The following is an amended generic character of *Liriosma,* drawn up from my own observations; and after the enumeration of its species, I purpose subjoining some remarks upon the affinities of the order to which it belongs:—

LIRIOSMA, Pöpp. Hypocarpus, *A. DC.*—*Calyx* parvus, carnosus, cupuliformis, disco adnatus, margine libero, crenato, vel obsolete 5-dentato, augescens, et ad fructum demum coalitus, eum tegens. *Petala* 6, sæpe usque ad medium geminatim laxe connata, carnosa, æstivatione valvata, apice processubus totidem inflexa. *Stamina fertilia* 3, petalis alterna, dimidio breviora, et ante suturam cujusque paris sita, e margine disci cupuliformis orta; *filamenta* complanata, pilis longis cottoneis barbata, demum glabra, libera, vel ad petalas imo sæpius laxe agglutinata, connectivo crasso lato continua; *antheræ* introrsæ, ovatæ, cordatæ, 4-lobæ, 4-loculares, 4-valves, valvarum margine alterutro vicissim dextrorsum et sinistrorsum intrinsecus soluto, hinc longitudinaliter dehiscentes. *Stamina sterilia* 6, petalis opposita, et vix longiora, filamenta carnosula, longe barbata, demum glabra, apice appendiciformia et bifurcata, laciniis subulatis, acutis, tenuioribus. *Pollen* subglobosum, vesiculis 3 æquidistantibus notatum, integumentis tenuissimis. *Discus* hypogynus, cupuliformis, carnosus, calyce brevior et eo adnatus, ad marginem liberum inflexum petala et stamina suffulciens. *Ovarium* ovatum, per dimidium inferiorem disco circumdatum, et illic glabrum, primo omnino liberum, cito adnatum, superne conicum, glandula magna epigyna crassa carnosa pilosa undique tectum, imo dissepimentis incompletis 3-loculare, summo 1-loculare. *Ovula* 3, anatropa singulatim in loculis spuriis ab axi placentifero centrali (cionospermio) suspensa, apicibus in loculi summo indiviso simul conniventia. *Stylus* simplex, inclusus. *Stigma* capitatum, sub-3-lobum. *Drupa* baccata, ovata, monosperma, calyce adnato tecta, apice umbilicata. *Putamen* subtenue, coriaceum. *Semen* loculum implens, sulco longitudinali pro receptione raphes spurii (e

cionospermio in filum extenso) impressum. *Integumentum* tenuissimum. *Embryo* in *albumen* dense carnosum infra apicem inclusus, brevis, *cotyledonibus* minutis, ovatis, compressis, *radicula* ovata, umbilico proxima, supera.—Frutices *Brasilienses*; folia *alterna, breviter petiolata, ovata, integra* (*rarius subdentata*?), *punctata*; racemi *axillares, breves, pauciflori*; flores *parvi, pedicellati*; pedicellis *ebracteatis, articulatis*; *florum partes præmolles interdum sese laxe agglutinantes.*

1. *Liriosma candida*, Pöpp. (Nov. Gen. iii. 33. tab. 239);—foliis ellipticis, utrinque acutis, obiter remoteque serratis, vel integerrimis, utrinque glaberrimis; racemis axillaribus, corymbosis, plurifloris, folio dimidio brevioribus, calyce petalisque lineari-lanceolatis, glabris, istis extus virenti-cinereis.—Prov. Rio Negro Braziliæ, circa fluv. Teffê, confluentem Amazonicum.

The leaves are described as being 5 inches long, 2 inches broad, the flowers supported by two bracts, the calyx obsoletely denticulate, the petals thickened at their summit, 3-nerved, and coriaceous.

2. *Liriosma pauciflora*, A. DC. Prodr. viii. 673; Deless. Icon. Sel. v. 18. tab. 41. Olax pauciflora, *Bth. Linn. Trans.* xviii. 678; *Lond. Journ. Bot.* ii. 375. Hypocarpus pauciflorus, *A. DC. Prodr.* viii. 246;—foliis ovatis, obtusis, junioribus cum ramulis pedicellisque pubescentibus; pedunculo axillari brevi, 1–3-floro, et pedicellis calycibusque molliter puberulis.—Prov. Bahia ad Serra d'Acuruà; *v. s. in herb. Hook.* (Blanchet, n. 2795).

The above characters are wholly taken from the description of Mr. Bentham, who also states that the ovarium is adnate to the calyx; the lower half is without doubt subsequently so, by the intervention of the cupular disk, but I suspect that at an earlier stage it is entirely free from the disk, as occurs in *L. Gardneriana*: the upper uncovered moiety, as in that species, is covered with short erect hairs. The only specimens known were collected by Blanchet in the Serra d'Acuruà or Açuà,—the rich diamond district discovered a few years ago in the province of Bahia.

3. *Liriosma Gardneriana*, A. DC. Prodr. viii. 679. Olax Gardnerianus, *Bth. Lond. Journ. Bot.* ii. 375. Hypocarpus Gardnerianus, *A. DC. loc. cit.* viii. 216;—foliis lanceolato-oblongis vel ovato-oblongis, acuminatis, apice obtusiusculo, imo subrotundatis, textura teneris, ramulisque glabris; racemulo brevi 4–12-floro, pedicello pedicellisque pulverulentis, calyce petalisque extus glabris, ovario pubescente.—Prov. Cearà, Serra de Araripe, prope Bomjardim (Gardn. n. 1957).

This is a small tree about 12 feet high, with odoriferous flowers, and with leaves mostly 3 inches long, 1¼ in. broad, on a petiole of 2 or 3 lines; the petals are of a sulphur-yellow colour, linear, 3 lines long, thick, fleshy, and quite glabrous. The six sterile stamens are two-thirds the length of the petals, and are always placed opposite to them; the three fertile stamens are shorter, and situated at points between each second petal, and are therefore alternate with them; all the filaments are free above, but adhere at their base to the petals for the length of a quarter of a line, by which agglutination these are formed into three distinct bifid petals, cleft nearly to the base; but the filaments are easily detached, and then the united petals separate of themselves, thus showing the corolla to be in no degree gamopetalous; the four anther-cells open by two longitudinal lines, as above described, and are filled with a number of pollen-grains, aggregated into a mass, by a quantity of loose yellowish grumous matter: the pollen-grains are roundish, with three globular equidistant, marginal vesicles, each terminated by a mammillary point; they are extremely thin in texture: all the filaments, both sterile and fertile, are covered with long white cottony hairs, which ultimately become glued to the petals. The ovarium is half immersed in the cupuliform disk; the exserted moiety is covered by the fleshy epigynous gland, which is hairy: before æstivation, the lower portion of the ovarium is quite free from the enveloping disk, but it soon becomes agglutinated to it, by the same mucilaginous exudation (probably evolved by the disk) that glues the base of the stamens to the petals: even after the ripening of the flower, the cupuliform disk is most easily separated from the ovarium, without the slightest rupture of the parts; but it cannot be torn away from the calyx without laceration.

4. *Liriosma Velloziana*, A. DC. Prodr. viii. 673. Olax Velloziana, *Bth. Lond. Journ. Bot.* ii. 375;—ramulis glabris, foliis obovatis, acuminatis, et mucronulatis, basi obtusiusculis, reticulato-venosis, nervis divaricatis, utrinque glaberrimis, petiolo brevi, canaliculato; racemo brevi, axillari, 3–5-floro; ovario pubescente; fructu ovali, incarnato, pulpa molli.—Rio de Janeiro.

The leaves are smaller than the last species, about 2 or 2½ inches long, 1¼ inch broad, on a petiole 3 lines in length; they are acuminated from the middle of the leaf, and are more fleshy and opaque: the raceme is shorter; the drupe is oval, 9 lines long, 6 lines in diameter, polished, and of a light scarlet colour, with a circular brownish depression in the apex; it is soft and fleshy, inclosing a thin subosseous putamen; the details of the structure of its seed will be found in the following remarks on the affinities of the natural order to which it belongs. This is a low growing tree, which I found in the wooded margins of the bay of Jurujuba; it is among Gardner's collection, no. 5380*.

Observations on the Affinities of the Olacaceæ.

The family of the *Olacaceæ*, first proposed by Mirbel, in 1813, under the name of *Olacineæ*, was placed by him near the *Aurantiaceæ*: Jussieu stationed it in proximity with the *Sapotaceæ*, while DeCandolle following the views of Mirbel arranged it close to *Aurantiaceæ*, a conclusion adopted by most succeeding botanists, and among these Endlicher and Meissner, who disposed it with *Aurantiaceæ*, *Meliaceæ*, *Humiriaceæ*, &c., in a class called *Hesperides*. Brongniart however followed the original views of Mr. Brown, in regard to the affinity of *Olax* with the *Santalaceæ*; but upon less satisfactory grounds, he associated with these the *Loranthaceæ*, excluding at the same time *Ximenia* from the family. Dr. Lindley in his 'Nixus Plantarum' and 'Natural System' offered a new view, by placing it, under the designation of the *Olacaceæ*, in the same alliance with the *Pittosporaceæ* and *Vitaceæ*, for which position few and not very satisfactory reasons could be offered. Mr. Bentham, in an excellent memoir on the *Olacineæ* (Linn. Trans. xviii. 676), proposed a new arrangement of the order into three distinct tribes, adding several new genera, together with his ingenious views in regard to its affinities, when he justly denied its relation with the *Aurantiaceæ*, although he admitted its approach to the *Humiriaceæ*, considering both these families to be approximate with the *Styraceæ*; and lastly he allowed, that through *Opilia* and *Cansjera*, the *Olacineæ* evidently osculate with the *Santalaceæ*. Finally, Dr. Lindley (Veg. Kingd. p. 43) repeated his former views, with some modifications, placing it in his alliance of the *Berberales*, together with *Droseraceæ*, *Berberidaceæ*, *Vitaceæ*, *Pittosporaceæ*, &c., an alliance which, as Dr. Asa Gray very justly remarks (Gen. Pl. Un. St. i. p. 78), "is there placed on peculiar grounds by no means compatible with ordinary views of botanical affinity." In estimating the value of these conflicting opinions, I will endeavour to show, that notwithstanding their extreme divergence, they will allow of a considerable degree of approximation.

We have the strongest evidence of the approach of the *Olacaceæ* towards the *Santalaceæ*, in the singular and important consideration of the structure of the ovarium and the seed; and if we consider the biserial floral envelopes of many of the genera of the latter order to be calyx and corolla, both of which are often most distinctly developed, as in *Choretrum, Leptomeria, Leptonium* and *Mida,* as also in *Quinchamalium, Arjoona* and *Myoschilos,* it is clear that its relationship towards the *Olacaceæ* is infinitely stronger than with the *Thymeleaceæ, Proteaceæ* and *Lauraceæ,* to which, in fact, they claim but a most distant affinity. This consideration did not escape the penetration of Mr. Brown, who more than forty years ago, and some time before the establishment of the family of the *Olacaceæ,* suggested* that the floral envelope called perianthium in the *Santalaceæ* may be looked upon as analogous to the same organ called corolla in *Olax,* and the calycular appendages may be viewed as a distinct calyx, alike in both instances; and hence, with equal reason in one case as in the other, we may consider the floral envelopes to be dichlamydeous rather than monochlamydeous: or we may imagine, that at a very early period in the development of the bud, the calyx and corolla have become connate, and hence grown into one common envelope,—an hypothesis rendered very probable from the constant thickness of its substance, and its divisibility into two distinct laminæ. I was led to a similar conclusion many years since by the examination of the Chilean genera *Quinchamalium, Myoschilos* and *Arjoona,* which have all a very distinct calyx, while the more conspicuous envelope, hitherto called perigonium, is decidedly petaloid in texture. Under this point of view, a close relationship will be found to exist between the *Olacaceæ, Santalaceæ* and *Styraceæ,* to which perhaps may also be added the *Myrsinaceæ* (but not the *Primulaceæ*), and it would then remain to be decided, in what part of the system such an alliance ought to find its place. I will not at present stop to offer proof of the alliance of the *Santalaceæ* with the orders above-mentioned, as I shall shortly have to revert to that consideration, but assume the fact for the present as one that admits of little doubt, and proceed to speak of the affinities of the *Olacaceæ* in other quarters, taking this family within the limits it has hitherto embraced.

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* A representation of this plant and an analysis of its fruit, together with the details of the floral structure of the preceding species, is given in Plate 3 of this work.

I have alluded to the relationship of the *Olacaceæ* with the *Styraceæ,* but in so doing it is requisite here to state, that I consider the *Symplocaceæ* as ordinally distinct from the *Styraceæ,* as will be made apparent when I describe two new genera appertaining to the former family. Don first suggested this separation, but he does not appear to have been aware of all the facts that prove their want of identity. In the *Symplocaceæ* we find a calyx of five imbricate sepals, a corolla with very imbricated æstivation, numerous stamens, placed in many series upon the corolla, having ovate 2-lobed anthers, without intervening connective, an inferior ovarium, showing a strict union of its carpels into five complete cells, and seeds of very different structure. In the *Styraceæ,* on the contrary, we have a tubular calyx with an almost entire border, petals with a distinctly valvate æstivation, stamens in a single series, generally double the number of the petals, and therefore by turns, opposite and alternate with them; here the anthers are linear, dorsally affixed upon a very fleshy connective; the ovarium is superior, wholly free from the calyx, with a remarkable pulvinate depressed epigynous gland; it is 3-locular at base, the dissepiments separating from the axis about its middle, and gradually disappearing at the apex, where it is completely unilocular, the base of the style being hollow, and continuous with the cavity of the cell; the cionosperm rises in the axis above the point of the separation of the dissepiments, and to the axile column are attached three fleshy placentæ, each bearing several ovules (about nine) in three rows, the upper series being erect, the middle horizontal, the lowermost suspended, the summit of each ovule being borne upon a cupshaped strophiole, as in the *Celastraceæ* : of these only a single seed becomes matured, as in *Olacaceæ* ; it differs however in being erect, and showing at its base the remains of the abortive ovules : the radicle of the embryo, enclosed in fleshy albumen, is directed to the point of attachment, as in *Olacaceæ,* but owing to the different position of the seed, it of course assumes a contrary direction, and points to the base of the fruit; the cotyledons are much larger and more foliaceous than in *Olacaceæ.* These points of structure are evidently quite opposite to what we find in the *Symplocaceæ,* and it is surprising they could ever have been associated together. The characters of the *Styraceæ* are however analogous to those of the *Olacaceæ,* and there exists a very close affinity between the two families. The corolla is in no degree more gamopetalous in *Styraceæ* than it is in *Olacaceæ,* for in both cases the petals are valvate in æstivation, at first cohere slightly by their margins, and finally separate nearly to the base, where a short portion always remains agglutinated, by the adhesion of a very thin annulus, from which the stamens originate; but upon removing this annulus the petals will be found to separate easily, and not to be really confluent into a gamopetalous tube. We also see in *Liriosma* the same tendency to the adhesion of its parts, carried even to a greater extent than in any instance I have found in *Styraceæ* ; and in *Schöpfia,* which is justly included by Mr. Bentham in the *Olacaceæ,* we see a still greater tendency to a confluence of its parts. If therefore the *Olacaceæ* have been placed by all botanists among the pleiopetalous orders, there can be no reason why the *Styraceæ* should be considered as a monopetalous family. The ovarium in *Sty-*

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* Prodr. 352.

raceæ is stated by most authors to be half inferior, but I have observed that at an early stage, and even after the fall of the flower, it is quite free, although partly surrounded by the tube of the calyx; and if it become subsequently agglutinated to the latter, it is probably only at a late period, as we find to occur in *Liriosma*.

The *Ebenaceæ*, by most botanists, have been held to be closely allied to the *Styraceæ*, but this does not appear to me quite evident. Though placed among *Corollifloræ*, it appears to me that they should rather be arranged among the polypetalous groups, for their petals are often quite distinct, or when united, cohere so slightly as to be separated by a little force. The stamens, although sometimes adnate to the corolla, are most generally free, or at least originate in a fleshy disk, which sometimes assumes the form of a very short hypogynous tube. In one Brazilian species of *Diospyros*, I have found the albumen in the seed to be distinctly ruminated, as in the *Anonaceæ*, the embryo having a terete radicle and broad foliaceous cotyledons, much resembling in structure that of *Monodora*. *Cargillia*, according to Mr. Brown, a genus of this family, so nearly approaches the *Anonaceæ*, that the typical species was described by Jacquin as the *Anona microcarpa* (Fragm. xl. tab. 44. fig. 7), and by Dunal as the *Monodora microcarpa*. In the Brazilian species of *Diospyros* above alluded to, the seeds are imbedded in pulp, and covered by a mucilaginous arillus: they are also compressed, with a linear, basal, and somewhat lateral umbilicus, forming a deep marginal furrow, into the bottom of which cavity the extremity of the radicle subtends, as in several genera of the *Anonaceæ**. *Monotheca* and *Reptonia*, placed in *Theophrasteæ*, appear, from the descriptions given of them, to have little in common with that family, and to belong rather to *Styraceæ*, if we consider the basal placentations, which I have shown to exist in this last-mentioned order, as in the *Olacaceæ*; and the approximation of these genera to the *Anonaceæ* is again confirmed by the ruminated albumen of the seed of *Reptonia*. The relation of the *Ebenaceæ* with the *Olacaceæ* was, I believe, first pointed out by Jussieu, but few botanists have attended to the suggestion; from the indications just mentioned, it will probably be found, that a more fitting position for the *Ebenaceæ* in the system exists among the hypogynous Polypetaleæ, not far from the *Anonaceæ*, rather than in the monopetalous group, where it is placed in the 'Prodromus' of DeCandolle, and in the arrangements of other modern botanists.

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* A precisely similar structure is found in *Diospyros Candolleana*, according to Wight's 'Icones,' plate 1222, fig. 8 to 11. In several other instances in this family, the albumen is depicted in the same work as being distinctly ruminated, so that this may probably be a general character of the order, although so remarkable a feature is not noticed in any botanical work. Gaërtner however hints at the fact, but only in one instance out of the many species of *Diospyros* he describes; *D. tetrasperma*, which has its "albumen radiato-striatum, quasi fibrosum."

Mr. Bentham in his memoir before quoted gives his opinion, that among dichlamydeous plants, the family of the *Humiriaceæ* approaches most to that of the *Olacaceæ*; but in this inference he had probably in view his tribe *Icacineæ*, which I propose to remove altogether from the order: I cannot indeed perceive any close approximation between the two families. In the *Humiriaceæ*, the æstivation of the corolla is imbricated or contorsive, the stamens are many-seried, and numerous in respect to the petals, generally united into a monadelphous tube, or combined in phalanges, and they have a singular expansion of their fleshy connective; the ovarium is surrounded at its base by a thin, and somewhat membranaceous dentate ring; it has four or five complete cells, which by the thickening of the axile placenta are often again divided by a transverse partition. The fruit is a berry, having a 5-celled osseous nut, the cells being often 2-locellate, and the seeds are provided with the usual integumental coverings. This is in no way analogous to what is seen in *Olacaceæ*; but the *Humiriaceæ* present a more manifest affinity with the *Styraceæ*.

A considerable degree of analogy between the *Myrsinaceæ* and *Olacaceæ* is shown in the position of its stamens opposite the petals, which present an æstivation so little imbricated as to be sometimes mistaken for being valvate; they agree also much in habit and inflorescence. In *Icacorea* the ovarium is unilocular, with four ovules attached to a central free placenta, of which sometimes only one becomes matured, as in *Olacaceæ*; but here the analogy ceases, as the æstivation of the corolla is contorsively imbricate and the seed presents all the characters of the *Myrsinaceæ*. This family has been arranged by most authors among the *Monopetaleæ*, but for the reasons before urged in regard to the *Ebenaceæ* and *Styraceæ*, it should be transferred to the *Pleiopetaleæ*. In *Mæsa*, *Samara* (*Choripetalum*, A. DC.), and *Embelia*, the corolla is decidedly pleiopetalous, and in the other genera of the order the petals are only slightly coherent at base, the ovarium being in all cases superior, except in *Mæsa*, where it is said to be partly inferior, but probably not so at an early period. The disposition to produce red dots in all parts of the plant in *Liriosma*, as in the *Myrsinaceæ*, is common to several families of the *Thalamifloræ* of DeCandolle's arrangement. Some degree of analogy may also be perceived between the *Myrsinaceæ* and the *Anonaceæ*, *Lardizabalaceæ*, and *Menispermaceæ*, in the development of the ovule, in the arilliform growth of the placentary indusia, as constantly witnessed in the two former families, and frequently in the latter, and in the deeply concave hilum, formed by the increment of the seed around the placenta, which is drawn into its cavity, and the consequently somewhat arcuate direction of the embryo within the albumen, seen more especially in the tribe *Heteroclineæ* among the latter family. There are other considerations to be held in view, that the *Primulaceæ, Myrsinaceæ,* and *Theophrastaceæ,* offer a free central placenta within the ovarium, without any appearance of parietal septa, or any connexion of the placenta with the style: we see also in the *Illicibraceæ, Mesembryanthaceæ,* and *Portulacaceæ,* a somewhat analogous development; but in these cases we cannot imagine this to be the result of the rolling up of the placentary margins of one or more carpellary leaves, according to the hypothesis generally entertained; but we may rather conceive, that the margins of the carpellary leaves constituting the ovarium have not the power of developing ovuliferous placentæ, a power seemingly there confined to the rudimentary petiolar support or gynophorus, which throws out its placentary threads, that are free in *Portulacaceæ,* &c., but confluent in *Primulaceæ, Myrsinaceæ, Theophrastaceæ,* &c. This view is confirmed by the appearance of the lengthened thread that grows up from the torus with the elongation of its seed, and its placentary attachment, in the instance of *Ægiceras.* We may therefore look upon this mode of development as the opposite extreme of the case of the multilocular ovarium, where its intrafolded placentations unite in a central axis; and we may look upon the *Olacaceæ, Styraceæ,* &c., as forming an intermediate state of development. Under such an hypothesis, keeping in view the considerations before mentioned, it would tend to a more natural division of the system, to remove all the several orders, from the *Lentibulariæ* to the *Styraceæ,* from the position assigned to them in the arrangement of the 'Prodromus.' Yet because the development of the ovaria in these instances may be traced to somewhat similar causes, it does not necessarily follow that they must all be allied together, for other considerations of equal moment may tend to keep them far apart. Thus from circumstances before enumerated, the *Styraceæ* and *Myrsinaceæ* might be associated with the *Olacaceæ* and *Santalaceæ,* between *Berberidaceæ* and *Rhœades,* in a group that might be called *Cionospermæ,* as I suggested on a former occasion (*huj. op.* vol. vii. p. 207), and in this group the anomalous genus *Aptandra* will naturally find its place. On the other hand, the *Sapotaceæ* with their truly axile placentation, the complete cells of their ovarium, and their corolla more pleiopetalous than monopetalous, appear more naturally allied to the *Aquifoliaceæ,* in which family the petals are also generally combined at the base into a tube. The

Ebenaceæ, as before suggested, appear to belong to the neighbourhood of the *Anonaceæ* rather than of the *Aquifoliaceæ,* with which family they are strangely consociated by Dr. Lindley (Veg. Kingd. p. 594) in the same alliance with the *Gentianaceæ, Apocynaceæ,* &c. The affinity of the *Styraceæ* with the *Humiriaceæ* has been already indicated. The *Primulaceæ,* together with the *Lentibulariaceæ,* appear to have more relation with the *Plantaginaceæ* and *Hydrophyllaceæ,* an alliance that differs little from that shown by Dr. Lindley (Veg. Kingd. p. 637). The farther prosecution of these considerations would be foreign to the present purpose, and they are now only indicated with the view of assisting us in the determination of the true affinities of the *Olacaceæ.*

There is yet another family, to which the *Olacaceæ,* comprehending all the genera included in it by Mr. Bentham, will be found to offer many points of approximation,—I mean the *Aquifoliaceæ* of DeCandolle, the *Ilicineæ* of Brongniart, Endlicher and others; but I am not aware that this affinity has been before noticed. Many species of *Ilex* bear much the habit of the *Olacaceæ* and differ little in the structure of the flower from the tribe *Icacineæ,* except in the æstivation of the corolla and the unilocular apex of the ovarium. *Leretia,* indeed, bears a remarkable resemblance in its habit and inflorescence, and in the structure of its flowers, to a Brazilian species of *Villaresia,* differing principally in the æstivation of the corolla, and in the want of an inner carinated midrib in the petals; but in other points of arrangement there is very little variance, agreeing even in its unilocular ovarium, with two collateral ovules suspended almost parietally from near the apex of the cell. The structure of the fruit of *Villaresia* corresponds so far with that of the *Olacaceæ,* in having a single seed, with copious albumen, containing a small embryo near its summit, with a superior radicle, and small cotyledons. It may be well here to mention a fact, apparently yet unknown, which may serve to throw some better light upon the real affinities of the *Aquifoliaceæ.* I have found that the suspension of the ovules in the ovarium of *Villaresia* is not really parietal, as generally stated, for it is sometimes completely bilocular, with two ovules in each cell, collaterally suspended from each side of the dissepiment by a cupshaped strophiole, like that seen in the ovules of the *Celastraceæ;* but in ordinary cases the ovarium is unilocular, only by the suppression of one of the cells, and the confluence of the dissepiment with the pericarpial covering, for it is then always somewhat gibbous, and its wall much thicker on the side of the abortive cell, towards which the style is then constantly somewhat lateral: this fact serves to bring the genus completely within the pale of the *Aquifoliaceæ*, as it is evident that its ovules are really suspended from the normal dissepiment, not parietally attached to the wall of an originally solitary carpel. It will also serve to guide us to the true position in the system of *Leretia, Pogopetalum*, and the rest of the somewhat extensive group of the *Icacineæ*, which I shall be able to prove to be quite distinct, in many leading and essential characters, from the *Olacaceæ*. *Rhaptostylum*, an anomalous genus of the *Aquifoliaceæ*, accords with *Heisteria* in many remarkable points; they agree in habit and inflorescence, both having flowers in aggregated axillary clusters, growing out of imbricated buds; they have also a small 5-toothed calyx, a corolla of five petals partly cohering at base, but easily separable, with a valvate æstivation, ten stamens, five of which are opposite, and five alternate with the petals, and partly adhering to them, a trilocular depressed and somewhat stipitate ovarium, with a single ovule suspended in each cell, a short erect style, and a clavate stigma: this close approximation of characters is very apparent, but the subsequent development of the calyx is not recorded in *Rhaptostylum*, nor is the nature of its fruit known. The genus *Ptychopetalum* of Bentham also agrees with *Rhaptostylum* in its principal floral characters, but differs in its unilocular ovule with two suspended ovules, a nearly constant feature of the *Icacineæ*. From the description of Kunth, the three cells of the ovarium are symmetrical, and not lateral, as in *Pogopetalum*; and as the fact of the evanescence of the dissepiments at their summit probably escaped the observation of that botanist, we may safely conclude that *Rhaptostylum* will be found to belong to *Olacaceæ* rather than to the tribe of the *Icacineæ*, or to the family of the *Aquifoliaceæ*. *Iodina* again, which has always been referred to the last-mentioned family, really belongs, as I shall be able to show, to the *Olacaceæ*: this curious genus presents a minute cupshaped bractiform calyx, with an entirely free campanular fleshy corolla, half cleft into five acute lobes, with a valvate æstivation: a large fleshy cup-shaped disk, fixed on a distinct stipitate support within the corolla, surrounds the ovarium, and upon its margin the stamens are inserted; five of these are fertile, and placed opposite to the lobes of the corolla, the others are alternate, squamiform and petaloid, having been hitherto described as petals, but from their position they are evidently analogous to the sterile stamens of *Agonandra*, a new genus of *Olacaceæ*: the depressed ovarium, partly immersed in the disk, is unilocular, with two to five ovules suspended from a cionosperm, or free central placenta. *Iodina* from its habit, with its spinous leaves more resembling those of the Holly, might well be supposed to belong to *Aquifoliaceæ*, but the æstivation of its corolla, and the peculiar structure of its ovarium, refer it, without doubt, to *Olacaceæ*. The genus *Iodina*, at first sight, offers a close resemblance to *Cervantesia*, which has in like manner five large petaloid scales, alternating with as many fertile stamens, and all originating in one common whorl, from the margin of a cupuliform disk; but in this genus the disk is not free, as in *Iodina*, but is entirely adnate with the tube of the floral envelope, so that when the fruit ripens, the drupe exhibits on its sides the persistent lobes of the corolla, and the petaloid stamens; but as the principal floral envelope must be regarded as a perigonium, having no calyx at its base, and as the disk is adnate with this perigonium, this genus must be referred to *Santalaceæ*, while *Iodina* and *Agonandra* must belong to *Olacaceæ*. There is one very unusual point of structure in *Cervantesia*, which appears to me without example; the floral envelope, deeply cleft above into five equal segments, is adnate to the disk, a little below the level of its free margin, but at this point it descends again below the same line of attachment, in the form of five other reverse segments, equal in size and continuous with the upper ones, and quite free from the disk and pedicel, which they enclose, so that it appears to consist of five elliptical segments, pointed and free, both above and below, and confluent only with each other and with the margin of the disk by a narrow transverse zone running across their middle: these inferior free processes must be spurlike extensions of the perigonium.

We have still another striking instance of the consimilitude in the external characters of the *Olacaceæ* and *Aquifoliaceæ*, which has led to a confusion of reference, in an opposite direction: this occurs in the genus *Bursinopetalum* of Wight, who assigned it to the former family, but which appears to me clearly belonging to the latter, as it agrees with it in the imbricate æstivation of its corolla; the petals, though distinct, and somewhat valvate at base, are decidedly imbricated for at least two-thirds of their length, two alternate petals being exterior to the others, and their margins overlapping to a considerable extent; they have the same prominent internal keel, and the apex is deeply inflected by long processes, which are torsively complicated together, as in *Villaresia*; the ovarium (probably from a similar cause) is unilocular, with an ovule (or two?) suspended on one side from near the summit of the cell; so far all accords with the last-mentioned genus, but it differs in having its ovarium half immersed in the fleshy torus, which however occurs sometimes in *Ilex*. Although the ovarium is at first almost superior, it subsequently becomes inferior by the growth of the fleshy torus, or disk, and it is the lower portion only that acquires increment, for the fruit ultimately is invested by the enlarged calyx, now become adnate, and is crowned by its five persistent teeth, the originally superior portion of the ovarium, and the base of the style, forming an umbilical scar upon its summit. The most prominent feature, however, is in the development of the fruit, and its structural resemblance to that of *Villaresia*; this is a drupe containing a very thick ligneous putamen of considerable size, which is one-celled; but the longitudinal parietal placenta seen in the ovarium has now become so much thickened, and extended across the cavity of the cell, as to make it thus appear as if it were almost bilocular, and its single seed hence becomes inflected around the placenta, and made to assume the form of the cavity thus formed, which in its transverse section is hippocrepiform: the seed, as in the *Aquifoliaceæ*, has a copious albumen, with a small embryo near its summit, having a superior radicle, pointed towards its apex. From the identity of this construction to that of *Villaresia*, we may reasonably conclude, that in *Bursinopetalum* the more normal condition of the ovarium is also bilocular, which indeed is evident from the hollow, or longitudinal slit, lined with a distinct membrane, seen to extend down the middle of the thickened incomplete dissepiment, and which is most probably the vestige of the abortive cell. These facts all tend to prove, that however structurally opposed the *Aquifoliaceæ* may be to the *Olacaceæ*, they possess so many external characters in common, as to have led the most expert botanists of our time to confound the two orders, by placing several genera in one family that belong to the other, and *vice versâ*. I will here mention that *Pogopetalum*, placed by Mr. Bentham in *Olacaceæ*, differs from that order, and especially from all the other genera of his tribe *Icacineæ*, in which it is placed, by having its ovarium always completely 3-celled: from the lateral position of these cells, it is manifest that their normal number must be five, in correspondence with the other parts of the flower. This would bring the genus nearer in accordance with *Ilex*, but it differs from that genus and all others of the *Aquifoliaceæ* in the æstivation of the corolla.

In order to prevent the same confusion in future, it is very desirable to reduce the *Olacaceæ* within more uniform and certain limits, and I therefore propose to confine this family to those genera that have a free calyx, more or less entire; four to six distinct petals, always valvate in æstivation, and sometimes adhering by the margins at their base into a somewhat gamopetalous tube, but which by a little force may be separated from each other without any laceration; stamens generally equal in number to the petals and opposite to them, sometimes double that number, in which case they are by turns opposite and alternate, or at times one half of them are sterile and appendiciform, or in shape of petaloid scales. Around the ovary are sometimes free hypogynous glands, alternate with the petals, but generally these are combined into a cup-shaped nectary, which in some instances, as in *Liriosma,* is free from the ovarium and partially adnate to the calyx; but in others, as in *Schöpfia, Iodina, Arjoona,* and *Quinchamalium,* it is wholly adnate to the ovarium and free from the calyx, while in *Cathedra* it is free both from the calyx and ovarium. This hypogynous disk, when developed, always bears on its margin the petals and stamens. The ovarium is always wholly superior with respect to the calyx, but often partly immersed in the cupuliform disk, and is frequently surmounted by a remarkable fleshy epigynous gland, which sometimes wholly covers its upper moiety; it bears a simple style, and a more or less clavate stigma. The internal structure of the ovarium is always constant in its character; unilocular at its summit, and more or less divided at base into incomplete cells, by spurious dissepiments, which separating from the axis, are often continued along the walls of the cell, in the form of so many narrow parietal keels. The placenta is axile, united at base with the short incomplete dissepiments, but quite free above, in the shape of an axile column, from which are suspended as many ovules as there are pseudo-dissepiments; these are generally three in number, more seldom two or five, and rarely by abortion only one, as occurs sometimes, but not always, in *Opilia*: this axile placenta, very distinct from the ordinary trophosperm, and which I have elsewhere proposed to call a Cionosperm (from *κίων, columella*), sometimes does not extend beyond the point of insertion of the ovules, while at others it rises above, in the form of an apical point, as in *Ximenia,* where it is prolonged far into a cavity of the style that is continuous with the cell of the ovarium, but in such cases it is always free and unconnected with it. One ovule only (as in the *Santalaceæ*) becomes matured into a fleshy drupe, which is sometimes supported at its base upon its unchanged calyx, while in others, as in *Olax, Heisteria, Cathedra,* and *Quinchamalium,* the calyx enlarges and encloses the fruit; and in some cases, as in *Liriosma,* the calyx increases in size, and becoming adnate, forms the fleshy external covering of the drupe. The putamen is one-celled, containing a single suspended seed; this, at first sight, presents a naked albumen filling the cavity, as in *Santalaceæ,* but the membranaceous and pellicular integument will be found adhering to the inner face of the cell, and when separated, there will be seen on one side a funicular raphe-like thread, extending from the base to near the summit, which is merely the attenuated remains of the placentary column, with the abortive ovules, still visible, at the apical point of attachment to the integument. The embryo is small, terete, and seated in the axis of the upper portion of the albumen, the radicle being always superior, and the cotyledons very small and compressed, directed towards the centre of the nucleus. To such characters I have found the following genera correspond, viz. *Ximenia, Heisteria, Olax, Schöpfia, Strombosia, Cathedra, Iodina, Liriosma, Opilia, Arjoona, Quinchamalium,* and two new genera, *Agonandra* and *Endusa*. The order thus restricted is marked by more distinct and coextensive characters than those proposed by Mr. Bentham, and will be seen to comprise only his tribes *Olacaceæ* and *Opilieæ*. The latter tribe however cannot be maintained, as I find that *Cansjera* does not belong to the family*, and that *Opilia*, although often with only a single suspended ovule, sometimes exhibits two or three ovules, as I have distinctly seen in *O. amentacea*. This fact was evidently more than suspected by Mr. Bentham, who says (*loc. cit.* p. 674) that it appeared to him there were two ovules in *Opilia*, three or four in *Cansjera*, a circumstance rendered probable by the evidently compound nature of the stigma in both genera, but which on account of the excessive minuteness of the parts he could not ascertain from dried specimens: after fecundation he never found traces of more than one ovule. The order however will admit of being divided into tribes, by some of the characters already indicated, but in a subsequent memoir I will offer my views on this subject.

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* The genus *Cansjera*, first placed in the *Thymeleæ* by Jussieu, was retained there by all subsequent botanists, till removed to the *Olacaceæ* by Mr. Bentham, who concluded it was allied to *Opilia*, because he considered it to have a small distinct adnate calyx, and an unilocular ovarium, with a single ovule suspended from the summit of a free central placenta. All the specimens I have examined of both known species, from various localities, and in different herbaria, present characters constantly at variance with these conclusions and more in accordance with the description given by Lamarck (Dict. iii. 433). Here I can observe no trace of any distinct calyx, but the floral envelope, which is a simple tubular perianthium, is supported at base upon a small and pointed navicular bract: the four stamens are adnate in the upper portion of the tube, equal to the number of the lobes of the border, and opposite to them; four tridentated, free, hypogynous scales alternate with the stamens; the long conical ovarium is seated upon a narrow glandular support, from which the scales originate, and the style is surmounted by a large 4-lobed capitate stigma. The ovarium I find to be constantly 4-locular at base, and one or more (generally two or three) of these minute cells extend irregularly like narrow and interrupted channels, to the upper portion, and the fecundating threads may be traced from all of them, most distinctly, to the style: a single ovule is seen, sometimes higher, sometimes lower, from a prominent line of placentation on one side of each ovuliferous channel which at the point of the development of the ovule becomes widened, and here the placenta is somewhat curved, by the ascending direction of the ovule. The seed is a drupe, apiculated by the base of the style, and supported below by the remains of the shrivelled perianthium; it contains an oval coriaceous putamen, which encloses a single erect seed; a short receptacle is seen at the base of the cell, which enters into a corresponding hollow in the seed, and from it extend, in a cruciform direction, four prominent keels or ridges, which penetrate as many furrows observable in the albumen: the testa and integument are membranaceous, the albumen solid and fleshy, and an embryo of half its length is placed in the axis of the upper moiety: this embryo is slender, cylindrical, and terete, its superior radicle is oval, clavate, six times shorter than the linear cotyledons, of which there were three, equal in size, in the specimen I examined: from the extremity of the cotyledons a thread extended to the umbilicus in the axis of the albumen, which was probably the remains of the embryonary sac. These characters cannot in any single respect be made to correspond with the *Olacaceæ*, and *Cansjera* must again be assigned to its former place, as an anomalous genus of the *Thymeleaceæ*, until a more fitting position can be given to it.

As I shall have shortly to treat of *Leretia*, and other correlative genera, I shall be able to detail at greater length the numerous observations that have induced me to propose the separation of Mr. Bentham's tribe *Icacineæ* from the *Olacaceæ*; it will at present be sufficient to state, that they constantly differ in having the stamens alternate with, not opposite to the petals; they always want the hypogynous disk that forms so frequent and so remarkable a feature in that family, although they sometimes exhibit a similar epigynous gland upon a superior ovarium; they differ also most essentially in the structure of their somewhat gibbous ovarium, which normally will be seen to be 5-celled, but which with a single exception is by abortion always completely unilocular, and without the smallest indication of any free central placenta, the ovules being generally two in number, attached somewhat laterally, from near the summit of the cell. The fruit differs most essentially in structure from that of the *Olacaceæ*, being a drupe, enclosing a single nut, with a solitary albuminous seed, that is covered with the usual testa and inner integumental envelopes, and distinguished by a well-marked chalaza and raphe, which, as in *Euonymus*, is averse or dorsal in respect to the axis of placentation. This is very manifest in *Pennantia*, a genus clearly belonging to this family.

In a former page (*ante* p. 29), while speaking of *Villaresia* and *Bursinopetalum*, genera belonging to *Aquifoliaceæ*, I pointed out the existence of the identity of structure of the ovarium in those genera with that of the *Icacineæ*, and I stated many other circumstances, tending to prove how closely this tribe is related to that family, and that its affinity with the *Olacaceæ* is in reality very distant. This very different structure of the ovarium did not escape the penetration of Mr. Bentham, but as he had not observed the constant, essential, and dissimilar points of floral structure, as above described, he states in the memoir before cited, that he did not consider the single fact noticed by him to be a sufficient reason for separating the *Icacineæ* from the *Olacaceæ*. It is evident however, from the many circumstances enumerated, that this group must form a distinct family (the *Icacinaceæ*), and it will consist of the genera *Icacina, Mappia* (Juss.), *Apodytes, Rhaphiostyles, Stemonurus* (identical with *Gomphandra*), *Leretia, Phlebocalymna* (Griff.), *Sarcostigma, Poraqueiba, Pennantia, Ptycopetalum, Pogopetalum*, and *Desmostachys.*

I am aware of the objections that will be raised by some botanists, who are averse to multiplying the present number of orders, but it appears to me most important to the advancement of science, to detect in the various natural groups of plants, a few decisive characters, by which they can be readily distinguished, and this should be accomplished, even at the risk of increasing the number of families: this indeed is a far less evil than the opposite extreme, where, by reducing too much the divisions of the system, the most opposite characters often become blended in one group, and we thus lose sight of every useful and well-defined line of demarcation. This inconvenience was pointed out on a former occasion (Illustr. South Amer. Plants, vol. i. p. 167), when I proposed the family of the *Atropaceæ,* but I then suggested, that if this were felt to be an evil, it might be counterbalanced, by classing in one immense family the *Scrophulariaceæ, Solanaceæ, Atropaceæ,* &c., which all partake of many similar general characters. In like manner the *Celastraceæ, Aquifoliaceæ, Icacinaceæ,* and perhaps some others, might be considered as suborders, but I am not yet prepared to define the exact limits of such a group. The same observations will equally apply to what I have said farther on, relative to the *Viscaceæ.*

We have now arrived at that point in this investigation, when we can better understand the exact relation existing between the *Olacaceæ* and the *Santalaceæ,* to which I have already alluded. The details given of the structure of *Cathedra* and *Liriosma* enable us to comprehend more fully the true nature of the floral parts seen in *Santalaceæ.* In the *Olacaceæ* we have observed that the ovarium is always superior, and quite unconnected with the real calyx, and that the cupshaped disk, which supports on its margin the corolla and the stamens, is sometimes, though not always, adnate with the ovarium, growing with it in such case, and producing a pseudo-inferior fruit, but which, in truth, never ceases to be superior. This we perceive in *Myoschilos,* a genus placed hitherto in *Santalaceæ,* where the hypogynous disk is adnate with the ovarium, and quite free from its triphyllous calyx, the stamens and petals being inserted on the margin of a free portion of the disk; thus it agrees with *Schöpfia* in all essential points of structure, except that its calyx consists of three distinct sepals, instead of being an urceolate 5-toothed tube. In

Quinchamalium we meet with a still nearer approach to the last-mentioned genus, for its calyx is also quite free, and in the form of an urceolate tube with a 5-toothed border; we have likewise a similar fleshy hypogynous disk, wholly adnate with the ovarium, and bearing on its margin a gamopetalous corolla; here also we perceive a similar development of the very prominent epigynous gland, that covers the somewhat depressed conical apex of the ovarium, but in this instance it rises in the form of a 5-grooved cylindrical tube, with a border of five rounded patent lobes, encircling the base of the style, and quite free from it. In *Arjoona*, as in *Myoschilos*, the calyx consists of three imbricate leaflets, but the outer one is considerably larger, and being 3-nerved, it consists probably of three confluent leaflets, so that the normal number of its sepals will hence be five, corresponding with that of the lobes of the border and stamens: the hypogynous disk is here less conspicuous, but it still exists, wholly adnate and continuous with the tube of the corolla: the epigynous gland is highly developed, being entirely free from the base of the corolla, by which it is concealed; the style originating on its umbilical and rounded apex. These three genera have hitherto been placed in *Santalaceæ*, but it is evident that to whatever order they belong they must be classed side by side with *Schöpfia*, a decidedly *Olacaceous* genus. In all the genera of the *Santalaceæ*, we meet with the presence of a large cupuliform disk, supporting the stamens externally on its lobed margin, and forming a most prominent and constant feature, but with this difference, that while in *Olacaceæ* this disk is frequently adnate with the ovarium and free from the calyx, in *Santalaceæ* it never invests the ovarium, but is adnate with the tube of the perigonium or calyx, forming generally a deep cup about the superior moiety of the ovarium, which in most of its genera is only half inferior: the cupshaped disk, in these cases, is therefore continuous with the fleshy epigynous gland. I am aware that it might be, as it has already been contended, that in *Schöpfia* its disk may be looked upon as an adnate calyx, its corolla as a perigonium, and its calyx as a tubular involucre; but such an argument can no longer be tenable when confronted by the structure seen in *Liriosma* and *Cathedra*, where we find a true solution of the nature of the cupuliform disk. There is however always this essential difference constantly existing between the two families: in the *Olacaceæ* the insertion of the corolla and stamens is on the margin of the disk; in the *Santalaceæ* this insertion is always outside of it; in the former these organs are articulated with it, and easily fall away; in the latter family it is impossible to separate the free lobes of the perigonium and stamens without force, and a rupture of the parts. But notwithstanding these prominent marks of ordinal distinction, there exists a regular gradation from one family to the other, as will be seen from the analyses I propose to offer; this proceeds from one extreme, *Opilia* (where the disk is developed in distinct free glands), through *Agonandra, Olax, Liriosma, Cathedra, Schöpfia, Arjoona, Quinchamalium, Myoschilos, Iodina, Cervantesia, Mida, Exocarpus, Santalum,* &c., rendering it difficult, through the osculant genera *Iodina* and *Cervantesia,* to draw a line through the strong limits of demarcation that exist between the two families.

The word *torus* has been employed by Mr. Bentham (Linn. Trans. xviii. p. 676) to describe in *Olacaceæ* what I have termed a *disk,* and which I have shown to be the same organ, but differently situated, that forms a constant feature, both in that order and the *Santalaceæ,* where in both cases, with rare exceptions, it is always deeply cupuliform and more or less lobed on its margin. I have adopted in preference the term "discus cupuliformis" as that given by Dr. Lindley for such a structure in his 'Introduction to Botany,' p. 161. This may not differ in its nature from a stipitate torus, but the adaptation in such cases of this last term, which is generally used in another sense, will naturally lead to ambiguity in our definition of structural arrangement; thus Mr. Bentham, in a subsequent work, appears to agree with Dr. Hooker's observation, after an original suggestion of Mr. Brown, in what appears to me an inconsequent conclusion, viz. that because in *Olacaceæ* the corolla is inserted into the disk, which is sometimes stipitate, or what he calls the apex of the pedicel, the calyx in such case should be considered in the light of an involucre (Flor. Nigrit. p. 261). I can perceive no reason why this should be a necessary consequence, for we see in the *Capparidaceæ* the development of the stipitate torus carried even to a much greater extent, supporting the stamens on its sides and the petals below them; but no botanist in these instances has ever thought of considering the calyx to be of the nature of an involucre, which it ought to be if the above reasoning were valid: this incongruity is rendered still more evident, when we remember that the argument was applied in the case of *Rhaphiolepis,* a genus of the *Icacineæ,* which I have shown to differ little from the *Aquifoliaceæ.* The word torus is generally confined to that fleshy termination of the peduncle in the bottom of the calyx seen in *Ranunculaceæ,* and more especially developed in such orders as the *Anonaceæ, Magnoliaceæ,* &c., but when it rises in more varied or determinate shapes, it takes the name of hypogynous glands, annular ring, flat, pulvinate or cupuliform disk, &c., according to the peculiar form it may assume, or the position in which it is engendered.

The epigynous gland, so highly developed in *Schöpfia, Arjoona, Cathedra,* and other genera of the *Olacaceæ,* is an equally constant feature of the *Santalaceæ*, where in *Exocarpus aphyllus* it is largely and prominently seen in the form of a 4-lobed cushion, broader than the summit of the ovarium, which is almost entirely superior; this is quite independent of its hypogynous disk, which is also present as usual in the family. This organ, whose existence I first pointed out in *Hyoscyamus,* I have since found to occur frequently upon the summit of a superior ovarium.

This inquiry into the affinities of the *Olacaceæ* has led to another conclusion of some interest. In my memoir upon *Cathedra* (*huj. op.* p. 10), while describing its curious anthers, I pointed out a very analogous structure in *Choretrum* and other genera, mentioning at the same time a similar formation of the anthers in *Myzodendron,* so beautifully illustrated in the 'Flora Antarctica' by Dr. Hooker, who has there also given the analysis of its ovarium and fruit, proving by indisputable evidence its relation to the *Santalaceæ* and *Olacaceæ.* I will now endeavour to show, that neither this genus, nor *Viscum,* bear any relation to the *Loranthaceæ*, where they have been placed by almost every botanist. The genus *Viscum* has been a frequent subject of investigation by many eminent physiological botanists, and Richard first described the very remarkable structure of the anthers of *Viscum album,* of which we find no parallel formation: these are well represented (Ann. Mus. tom. xii. tab. 27) as being composed of very numerous cells, each containing distinct aggregations of pollen-grains, and which burst open and discharge their contents by the rupture and contraction of the vesicular tissue that covers their surface; in this respect it bears no resemblance to the structure of the anthers of *Myzodendron.* On the other hand, upon examining the anthers of the Brazilian species of *Viscum,* I find their structure quite opposed to that described in *V. album,* and somewhat analogous to those of *Myzodendron*; they are 2-lobed and subcordate, approaching much the form of those of *Cathedra*; they are quite distinct and free from the lobes of the perianthium, are nearly sessile, and consist of two parallel cells, enclosed in thick crystalline walls, as described in that genus, and appear to discharge their fertilizing power in the same ambiguous manner by two covered pores in the apex: the pollen is globular, quite smooth, vesicular, bursting irregularly, and so thin is their texture, that the sporular granules can easily be distinguished in them by transmitted light. All such species will therefore constitute a group generically distinct from *Viscum,* to which the name of *Allobium* may be given, from ἄλλος, *alius,* βιόω, *vivo,* in allusion to their deriving their support and nourishment from other trees. As far as my observation extends, many of the Asiatic species will be found to conform with the same genus. On some future occasion I will give more in detail the facts upon which I propose to separate from the *Loranthaceæ,* the genera *Viscum, Myzodendron,* and *Lepidoceras*: respecting *Eubrachion* and *Ginalloa* I cannot offer an opinion: *Antidaphne* from Pöppig's description is evidently related to *Loranthaceæ,* as well as *Tupeia**, on account of the structure of the ovarium.

It will be sufficient to remark at present, that in *Loranthaceæ* the flowers are generally hermaphrodite; the calyx, with a free and entire margin, is adnate with the ovarium; the petals are linear, frequently very long; the opposite stamens with lengthened filaments are free or only partially adnate with the petals; the anthers often versatile, always 2-lobed and 4-celled, bursting by two longitudinal furrows; the pollen is flattened, 3-lobed, and marked by three lines radiating from the centre; the ovarium is unilocular with a single ovule suspended from the summit of its cell; and the embryo, with large fleshy cotyledons, almost fills the cavity of the cell of the fruit, being covered with very thin albumen: finally they often form distinct trees, are frequently more epiphytic than parasitic, and the inflorescence is generally paniculate, with numerous pedicelled flowers, often of great size and brilliant colours. We perceive nothing like this in *Viscum, Myzodendron,* or *Lepidoceras,* where the flowers are always very minute, either diœcious or monœcious, and generally imbedded in decussate pairs in a fleshy spikelet. In the group I have called *Allobium,* the structure of the flower corresponds with that of most of the genera of the *Santalaceæ,* the calyx is obsolete, the corolla or perigonium has three or four short and 3-angular lobes, the sessile anthers already described are opposite to these segments, and alternate with the lobes of an internal adnate disk; in the female flowers, also 3- or 4-lobed, the ovarium is half immersed in a similar adnate fleshy cupshaped disk; it is 1-celled, with three ovules suspended from a free central placenta; the berry contains a single naked seed, enclosing a compressed heart-shaped albumen, with a minute embryo in its almost cordate summit; the radicle is terete, the upper moiety of which is nearly exserted, having only a thin pellicular albuminous covering; while its lower moiety, and two exceedingly diminutive cotyledons, are imbedded within the substance of the albumen, in the marginal sinus. These characters are so perfectly distinct from the *Loranthaceæ,* that it appears to me the genera above mentioned should form either a separate family (the *Viscaceæ*), or be considered as a suborder of the *Santalaceæ.* The only points of resemblance between *Viscum* and the *Loranthaceæ* are, the position of the stamens opposite the lobes of the corolla or perianthium, the manner of development of their seeds, their glutinous properties, and their parasiticism, characters equally possessed by other families: they are certainly quite distinct in habit. Mr. Griffith states, that the Indian species of *Viscum* have three ovules suspended from a central column, thus agreeing with the Brazilian species, which I have called *Allobium.* The ovules of *Viscum album* are said by M. Decaisne to be erect, but I have elsewhere offered reasons why we may infer that they are in reality suspended, and only apparently erect, as in *Champereia,* &c.

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* I have had an opportunity of examining the *Tupeia Cunninghamii,* which scarcely differs from the typical species, *Viscum antarcticum,* Forst.; it agrees with the characters assigned to it by Forster, Chamisso, and Schlechtendahl (Linn. iii. 203), Richard (Voy. Astrol. p. 269), and Miquel (Linn. xviii. 85). At the same time that it is in no way related to *Viscum,* it quite accords with the *Loranthaceæ,* and agrees in every respect with the characters given in Endlicher's 'Gen. Pl.' p. 802, of *Spirostylis,* a subgenus proposed by Presl and adopted by Blume (DC. Prodr. iv. 315). This species from Acapulco will therefore claim the name of *Tupeia Haënckeana, Spirostylis Haënckeana,* Presl, the former genus being proposed in 1828 the latter in 1829.

In first pointing out the affinity of the *Loranthaceæ* with the *Santalaceæ,* many years ago (Prodr. 352), Mr. Brown probably had *Myzodendron* and *Viscum* in view, as at a later period (Linn. Trans. xix. 232) he has alluded more distinctly to the similarity in the construction of the ovarium of the former genus with that which forms a pecular feature in the *Santalaceæ.* In indicating, on the other hand, the relation of the *Loranthaceæ* with the *Proteaceæ* (Flind. Voy. App. 549), the same distinguished botanist probably had only *Loranthus* in consideration. The evident affinity of *Viscum,* just mentioned, was also remarked by Prof. Decaisne, in his memoir on the pollen of that genus, before cited, on comparing the ovules of *Viscum album* with those of *Thesium.* Brongniart (1843), adopting this view, arranged the *Loranthaceæ* in a separate class, with the *Santalaceæ* and *Olacaceæ.* The same affinity between these three families (at least as far as regards *Myzodendron* and *Viscum*) has since been confirmed by Dr. Hooker, in his very able investigation into the relations of the former genus (Flor. Antarct. 293); and the strongest evidence in proof of this affinity is given in the complete analysis of its ovarium, from its early development to the perfection of the fruit, the details of which are there exemplified in plate 104. fig. 10 to 20, and plate 105. fig. 12 to 21.

After reviewing all that is here advanced, in regard to the affinities of the *Olacaceæ,* it is satisfactory to know that the conclusions to which my own observations have led me have been in great measure already anticipated by the inferences of such distinguished botanists: it is therefore with more confidence that I now repeat the suggestion proposed some time ago (*huj. op.*

p. 8), of uniting the several families distinguished by the characters there indicated into a distinct class (*Cionospermæ*), the place which it should occupy in the system having been already made obvious. If we look to the development of the reproductive organs in plants as a main element in the foundation upon which every natural method of classification should be based, then the arguments before adduced on this head ought to be considered with all the weight due to them (*ante* p. 26). I have there pointed out what appears to be the normal construction of the carpels in this group of families, and the sources from which the placentæ and ovules spring, and have again contrasted this with the normal structure of other classes of the system, the clear inference being, that the *Cionospermæ* should range in the *Thalamifloræ*, between *Polycarpicæ* and *Rhæades* (*ante* p. 26). Whatever may be conceded on this point as regards *Olacaceæ*, it may perhaps be objected, that a position so high in the scale is not compatible with the *Santalaceæ*, generally placed in a far lower grade; but if we consider the usual floral parts to be there existing and perfect, as we must admit from analogy, although but sparingly developed, this cannot be urged as a sufficient reason against the admission of that family into such a position, especially when no objections have been urged against the station assigned to the *Menispermaceæ*, placed in the midst of other families possessed of an unusually high extent of development in its floral parts, merely because its petals are reduced to the size of minute scales and its flowers very diminutive and diœcious. Neither did DeCandolle hesitate to arrange the *Myristicaceæ* in a similar position, although they have small diœcious flowers, with a simple perigonium; nor have any obstacles been raised against such a position by other botanists upon this score alone. Another objection may be urged, that in *Santalaceæ* the seed is often naked*, that is, deficient of any testa or integuments; but this is perhaps not always so, and its occurrence here, as we know it to be in other cases, is probably due to adventitious causes. We have every reason to believe, that the development of the ovule and its embryo in the *Olacaceæ* is analogous to what has been observed in *Santalaceæ*: assuredly the early growth of the ovules is effected under the same peculiar circumstances, and in the seeds of *Liriosma, Ximenia*, &c., the albumen appears naked, or at least, their only covering is reduced to a thin membrane, which in the dried state remains more or less attached to the inner surface of the putamen. The phænomenon of the development of these, which I have proposed to call exutive seeds (see last note), has been frequently observed by many eminent physiological botanists, more particularly by Mirbel, Schleiden, Meyen, Decaisne, and Griffith. The latter has shown, that among the changes that take place in these cases, is the constant prolongation of the embryonary sac, outside of the "nucleus*," or body of the ovule, and that it is curious to witness the rapidity with which this exserted portion grows, and here becomes filled with albuminous tissue: another result being the incorporation of the remaining portion of the sac with that tissue. A similar prolongation of the embryo-sac was also noticed by the same accurate observer in *Avicennia*†, and he infers that this phænomenon has only been remarked in cases associated with a particular form of free central placenta‡; but this is not correct, for we have evidence, that its occurrence is not constant among the *Cionospermæ*. We know likewise, from the observations of Mr. Griffith himself, that the same occurs in *Congea, Loranthus*, &c. Dr. Planchon also has minutely described a similar phænomenon in the seeds of *Veronica*§, where the embryo is formed without the usual integuments, and remains covered merely by its embryo-sac, that protrudes outside the main body of the ovule, improperly called the "nucleus," and which afterwards shrivels into the form of a secondary funicular cord: in these instances the embryonary sac becomes thickened, and assumes the appearance of a perispermal covering around the albumen of the seed, very different in its origin from the true testa of indutive seeds.

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* I do not use this term in the meaning employed by Linnæus, for seeds developed upon a gynophorus, such as *Labiatæ*, &c.; nor as used by Mr. Brown, to denote the seeds of *Coniferæ, Cycadeæ*, &c., in which sense it is now generally understood; but as no expression has been applied to the peculiar development under consideration, I would suggest that of *Semina exutiva*, as more peculiarly fitted to specify those, distinguished by the absence of the usual seminal tunics, contrary to the ordinary development in *Semina indutiva*.

We may infer that nearly the same changes take place in the development of the seed in *Olacaceæ* that Mr. Griffith has so minutely observed in *Santalum* and *Osyris*; for in the ripe fruit of *Liriosma*, examined in the dried state, independently of the thickened and lengthened cionosperm, which is pressed into a deep longitudinal groove, formed by its pressure, in one side of the albumen, I find constantly, midway between the axis and this groove, and imbedded in the substance of the albumen, a very distinct, long, cylindrical, membranous tube, which proceeding from the base terminates abruptly, by an almost truncated closed apex, at about half the length of the seed; the lower portion, at its exit, is reflected upwards round the base, for a short distance, in a small groove, and is soon gradually lost in the substance of the enveloping integument. We cannot imagine this tube to be anything else than the posterior end of the embryonary sac, which in *Osyris* Mr. Griffith describes as becoming incorporated with the nascent albuminous tissue, but which here appears to remain entire, and its existence in the position above described can only be accounted for by supposing its reduplication during the development of the albuminous tissue. On dividing the putamen, the albumen will be found quite bare of any integumental covering, except at the lacerated margin of the cionosperm, around the hollow space at the base, and about the summit, where it has broken away from the abortive ovules, which as well as the cionosperm become entirely pressed into the substance of the albumen: the rest of the extremely thin integumental covering remains adhering to the inner surface of the putamen; but whether the external body of the ovule becomes withered and contracted into the substance of the cionosperm, or whether its induvial remains are to be referred to the quantity of colourless, dislocated tissue found between the adherent membranes that form the lining of the putamen and the seminal integument, it is impossible to determine from an examination of dried specimens.

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* This term, though generally used in this case by botanists, is manifestly incorrect, and has been employed only because it is applied to the identical body which is enclosed within its several tunics in ordinary seeds; it leads to misconception, because it is difficult to imagine the "nucleus" can mean the external covering of the ovule, while the protruding real nucleary body becomes the entire seed. It would be more conformable to fact, and render the details of the phænomena more intelligible, to denominate the former, what it really is, the external body of the ovule, and not a "nucleus."

† Linn. Trans. vol. xx. p. 2.

‡ *Ibid.* p. 3.

§ Mémoire sur les développemens et les caractères des vrais et faux arilles. Montpelier, 1844.

Besides the knowledge of the singular fact of the exsertion of the embryonary sac, and the development of the embryo outside of the body of the ovule, common to the *Santalaceæ*, and by analogy to the *Olacaceæ* and other *Cionospermæ*, that of the confluence of the albumina of several sacs into one albumen is stated to occur in *Viscum album*: this however is not quite a manifest explanation of the phænomenon, for if these were confluent, the embryos would not unite at base, but would remain distinct, by the intervention of the confluent sacs, unless we imagine these membranes to become absorbed into the substance of the nascent albumen. Dr. Meyen, on the contrary, denies the fact so minutely described by M. Decaisne, in the memoir before quoted, of the growing together of several embryos; for he asserts, that several embryonary sacs are contained in a single ovule, and are fertilized, but it rarely happens that more than one of these arrives at perfect development*, and he therefore concludes, that the doubling or trebling of the radicular end of the embryo of *Viscum* cannot be owing to the cohesion of several embryos. It appears to me that many of the changes that really take place in such cases have not yet been observed, and that we have still much to learn concerning the true nature of such developments: this is a subject of deep interest, worthy of the most attentive examination. I have mentioned that in the *Olacaceæ*, as well as the *Santalaceæ*, although the cionosperm sometimes exceeds the limits of the ovules, the free apices of the three ovular bodies are more frequently seen to extend above the top of the column. M. Decaisne describes the ovules in *Viscum album* to be several and erect, that one of these becomes fertile, while the two others are abortive and appear like filaments at its base. It is probable that the cionosperm is here very short, and that the free apices of the ovules have been mistaken for the ovules themselves; it may be also that the free apices of the probably yet unimpregnated ovules, distinguishable in the ovarium of the *Olacaceæ*, *Santalaceæ*, &c., may be nothing more than the exserted portions of the embryonary sacs, so ably described by Mr. Griffith: these are points very difficult of determination in dried plants especially, where the parts are so extremely minute and delicate. In *Opilia*, and again in *Champereia*, the three suspended ovules, at the period of the fall of the flower, appear closely aggregated upon their columnar support, and from their extreme minuteness, they are easily mistaken for a single erect, stipitate ovule; but I have found, by alternately moistening and allowing them to dry, that air intervenes between the delicate membranes, and renders them clearly distinct. I have already alluded to the fact, but as yet we know nothing of the cause, of the non-production in all the *Cionospermæ*, as well as in *Viscum*, of the usual coverings that in ordinary cases are generated over the pristine ovule. We must not lose sight of the important circumstance, observed by M. Decaisne, that in *Viscum album* the embryo is not developed till a long period after the fall of the anthers*, nor of those of Mr. Griffith†, equally showing, that both in the Indian species of *Viscum* and *Loranthus*, the ovulum is a formation, subsequent to the act of impregnation; "a remarkable and unparalleled fact, that tends to increase the difficulty of understanding, or even conjecturing, the nature of the first steps in the formation of an embryo." These considerations become analogically of importance in leading us to the discovery of the real history of the *Olacaceæ*. Something in relation to this subject might be learned, if we could better understand the origin and development of the embryo under ordinary circumstances, for the facts are still undetermined that can prove which of the two theories of the nature of vegetable reproduction is founded on truth; the one maintaining that the pollen-grain penetrates the embryo-sac, and hence comes into immediate contact with the body of the nucleary vesicle, in order to effect its fertilization; the other denying this assertion, and declaring that it does not penetrate the sac, but merely discharges its function of impregnation, by external impression. Similar theories have long been disputed among zoologists, some contending that the spermatozoon does not penetrate the ovum in order to effect its impregnation, as mere external impact is sufficient to accomplish this function, while others declare the necessity of immediate contact, and that in proof of this they have seen the spermatozoa within the shell of the ovum. This point has just been determined by Mr. Newport, in a very interesting paper read before the Linnæan Society, in which he proves satisfactorily that the former view is conformable to truth. He has ascertained the important facts, that the presence of active spermatozoa are absolutely necessary to impregnate the ovum; that this is effected by simple impact; he has noted the time necessary to complete the operation, and has observed the internal change that immediately takes place in the body of the nucleus; and moreover he has found that the spermatozoa, after producing this effect by simple external impact, become inert and lose all power of motion. Mr. Newport has suggested that these circumstances, by analogy, may assist in determining the theories in dispute among vegetable physiologists; and he has pointed to the curious fact recorded by Mr. Griffith (Linn. Trans. vol. xx. p. 393) of the irritability or oscillatory motion seen within the boyaux of the pollen-grains of *Dischidia* at the period of impregnation of the ovules, which may perhaps be in some degree analogous to the vivacity of spermatozoa under parallel circumstances.

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* Ann. Nat. Hist. Ser. 1. vii. p. 171.

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* Sur le développement du Pollen du Guy, &c., Mém. Acad. Roy. Bruxelles, vol. xii.

† Linn. Trans. vol. xviii. p. 77.

Before proceeding further, I will advert to some considerations omitted to be made in regard to the relations of the *Humiriaceæ* (*ante*, p. 25), and which did not recur to me till after the preceding observations on the affinities of the *Olacaceæ* were printed: I have there stated that the *Humiriaceæ* present a more manifest affinity with the *Styraceæ*, than with the *Olacaceæ*. The novelty of this view renders it necessary that I should explain the reasons upon which such an opinion is founded. The structure of the ovarium of *Humirium* will be seen to be very similar to that I have described as existing in the *Styraceæ* (*ante*, p. 23), with this difference, that the junction of the partitions between the cells, at the axis, is almost complete, with the exception of a small portion at the summit, and this is only distinguishable under careful examination: the suspension of the ovules is from a short and free central placenta that rises above the absolute union of the dissepiments, in the very top of the ovarium, and the partitions about this spot, though they all converge as far as, and even touch the central placentary column, are yet really free from it. Although the five cells are here completely established throughout the entire length of the ovarium, still for a very short distance at the apex, there exists a communication between the cells, through the almost imperceptible chinks existing around the margins of such apical portions of the dissepiments as are really disconnected with, although touching the placentary column. The definition of Ad. Jussieu* of "loculis ad apicem inter se perviis," though quite true, is not a correct expression of the structure of the ovarium of *Humirium*. This offers much support to the views of Mr. Bentham in regard to the affinity of the *Humiriaceæ* with the *Olacaceæ*, but in other respects there seems less relation between the two families; for if in the ovarium of *Humirium*, the confluence of the dissepiments had been completed about the central placentary column to the very summit, the position of the *Humiriaceæ* in the system would have been close to the *Aquifoliaceæ*. From the structure of the ovarium and other characters, the conclusion now appears to me irresistible, that wherever the *Styraceæ* may be stationed in any natural arrangement, the *Humiriaceæ* must be placed in contiguity with them. The *Humiriaceæ* will therefore form one of those osculant relations, existing everywhere in nature, which can only be represented by the circular system, and never by any linear arrangement; in the former method the *Cionospermæ* would touch the *Dryales*, through *Humirium*, while in the linear system their location will fall to a distance. The position of the *Humiriaceæ* has never been satisfactorily determined: Von Martius, who first suggested the order in 1826, considered it allied to *Meliaceæ*, though doubtfully: Jussieu, in entertaining the same view, had similar misgivings in regard to this affinity. Dr. Lindley, in his 'Introduction to Botany,' held them more nearly related to the *Aurantiaceæ*, and Endlicher placed them at the head of a class called *Hesperides*, in association with the *Meliaceæ*, *Aurantiaceæ*, &c. Meissner stationed them also in the *Hesperides* of Endlicher, adding at the same time to this class, the *Olacaceæ*; and finally, Dr. Lindley in his 'Vegetable Kingdom' renounces his former views, and fixes them in a most singular association with the *Ericaceæ, Epacridaceæ, Monotropaceæ*, &c. Mr. Bentham (Linn. Trans. xviii. p. 682) considered "that among dichlamydeous plants, they come nearest to the *Olacineæ*;" but in this conclusion, as I stated before, he had probably in view his tribe *Icacineæ,* where in *Pogopetalum* there is sometimes a similar large fleshy connective, forming a conspicuous appendage much exceeding the length of the anthers, and it has also an ovarium of several cells with two ovules suspended from near the summit. In *Stemonurus* we find similar glandular cilia upon the filaments. In *Ptychopetalum* we have double the ordinary number of stamens, and in several genera of the same tribe, we perceive a hypogynous cup, with ten free lobes, investing the base of the ovarium. They resemble the *Icacinaceæ* also much in habit, having similar coriaceous exstipulate leaves, and terminal or axile inflorescence of small crowded flowers, each flower being supported on an articulated pedicel. Notwithstanding these distant indications, the real affinity of the *Humiriaceæ* appears to me to be nearest the *Styraceæ.*

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* Flor. Bras. Merid. A. St. Hilaire, vol. ii. p. 88.

While speaking of the latter family, I will offer a passing observation upon the anomalous genus *Diclidanthera,* placed doubtfully by Von Martius in *Ebenaceæ* or *Styraceæ,* by Lindley in *Styraceæ,* by Don in *Ebenaceæ,* and by Endlicher in *Styraceæ.* Prof. A. DeCandolle in his 'Prodromus' (vol. viii. p. 245) has given several reasons why it should be excluded from the last-mentioned order, but has not assigned to it any other position, and since then no other botanist has ventured to indicate its true locality in the system. I shall be able to demonstrate that its corolla is not gamopetalous, as generally stated; or at least that its petals are easily separable from each other, being only slightly agglutinated together by the feeble adhesion of the filaments to them. In its habit, its stipular alternate leaves, the linear form of its petals, their mode of æstivation, the stamens always double the number of the petals, the valvular and hinge-like dehiscence of its anthers, the suspension of a single ovule from the summit of each cell of its ovarium, the form and direction of the embryo with large foliaceous cotyledons in fleshy albumen, *Diclidanthera* will be seen to approximate closely to the *Hamamelidaceæ,* from which family it differs only in some slight characters, principally in the absence of the fleshy hypogynous disk that in *Hamamelis* and its congeners serves to agglutinate the base of the ovarium with the lower portion of the tube of the calyx, and which thus renders it semi-inferior.

Whether for this reason, it will form the type of a distinct Order, is a point to be determined when the family of the *Hamamelidaceæ* has been better investigated; but its proximity is certainly here, and in the meanwhile it may be desirable to place it in a separate tribe of that order.

I shall also be able to add some new evidence confirmatory of the observations of Dr. Arnott relative to the structure of

Grubbia (Hook. Journ. Bot. iii. 266); its alliance however appears to me nearer to the *Hamamelidaceæ* than the *Bruniaceæ*; and the tribe of the *Ophiriæ* including *Grubbia* and *Ophiria* (*Strobilocarpus*) may well form a sectional division of that order, the limits of which will require some modification to include this and the *Diclidanthereæ* as new and distinct tribes.

The structure observed in *Humirium* confirms what I urged in regard to the nature of a stipitate torus (*ante*, p. 36), and of that of the cupuliform disk so frequently alluded to in former pages. We there perceive an ovarium perfectly free and supported on a distinct gynophorus: this is surrounded at its base by a conspicuous cupuliform ring, toothed on its margin, but perfectly free, on both surfaces, down to the base: the ovarium is hairy in all parts, except in the basal portion inclosed within that cup, but not the slightest adhesion exists, either with its glabrous portion or with the gynophorus. Outside of this hypogynous cup is seen another cupshaped ring, serving to support the stamens, which in *H. floribundum* is entire, smooth, and fleshy outside, and supports the many series of filaments upon its margin as well as upon the whole of its inner face, forming thus an annular ring, free both from the hypogynous cup and the petals. Here therefore we perceive the gynophorus, cupuliform disk, staminiferous cup, petals, and sepals, each a distinct development, and each free to the base, but all springing from a fleshy torus which is simply an expansion of the apex of the pedicel. The torus, therefore, as an organ well marked in many of the *Thalamifloræ*, must not be confounded with any of the developments which it serves to support*.

Many of the inferences drawn from the numerous facts indicated in the foregoing "Observations on the Affinities of the Olacaceæ" are so much at variance with long-established opinions, that I cannot expect they will at first be favourably entertained. Experience has shown, when conclusions upon erroneous grounds have once been made by high authority, and these confirmed by every subsequent author, that nothing short of actual demonstration, and that of the most positive character, can establish other and more correct inferences. In the "Observations" alluded to, considerable doubt has been thrown on the deductions of some of the most eminent botanists,—men celebrated for the general accuracy of their researches, and for the soundness of their views regarding botanical affinities: I should therefore incur the charge of temerity in making the several bold statements there offered, unless I was prepared to give proof of all I had advanced:

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* See many excellent remarks, all tending to the same conclusions, in two chapters on the Disk and Floral Receptacle, in Aug. St. Hilaire's 'Leçons de Botanique,' p. 455–466.

a report of my observations upon the several genera of the *Olacaceæ, Santalaceæ, Aquifoliaceæ, Loranthaceæ, Styraceæ,* &c., will consequently be offered in succession, and the results of these researches will at the same time be demonstrated by analytical drawings.

OBSERVATIONS ON THE AFFINITIES OF THE ICACINACEÆ.

ONE of the foremost of the conclusions last alluded to, is the necessity of removing the tribe of the *Icacineæ* of Mr. Bentham from the family of the *Olacaceæ,* for which many cogent reasons have already been offered (*huj. op.* p. 33), and this group I propose to establish at once as suggested, either as a suborder, or more deservedly as a distinct family under the name above stated. In his excellent memoir on the *Olacineæ* before quoted, Mr. Bentham enumerated only eleven genera of that order, two of which were then first described by him. Of these five belonged to his tribe of the *Icacineæ,* and one I have shown has no relation there; hence only five genera out of that list were then known as really appertaining to the former family. I have now enumerated thirteen genera of the *Olacaceæ* (*ante,* p. 32), and an equal number of the *Icacinaceæ* (*idem,* p. 34)*. This last-mentioned group exhibits characters so widely different from those of the former, that it becomes necessary to place the two at a considerable distance in the system. These characters consist in their frequently polygamous, almost diœcious flowers; the alternate position of their stamens with respect to the petals; the evidently normal polycarpellary structure of the ovarium (for where developed with more than one cell, the dissepiments are always found complete at their summit); the pendulous position of their ovules, generally two in each cell, near the summit, where they are suspended, one always more or less above the other, from a peculiar cupshaped podosperm; their constantly indutive seeds; the existence of a distinct testa, of inner integuments, of a chalaza and of a raphe: all these are important differences, quite at variance with the very peculiar points of structure that characterize the *Olacaceæ.*

With such completely irreconcileable characters, there is only one proper course to pursue, and that is to separate them; but it then remains to be considered, where in such case they should be placed in the system, for it is evident that they cannot even remain in juxtaposition. In the face of the difficulty of combating long-established opinions, it becomes essential, at the risk of the charge of prolixity, to recapitulate here a few of the arguments before assigned, in order to guide us to a right decision. Proceeding upon the principle, that the most scientific basis for the distribution of plants is that founded on the characters which from their nature must be the most invariable, I mean those offered by the development of the organs of reproduction, we perceive a feature of most general occurrence, where the margins of the carpellary leaves are supposed to become placentiferous: sometimes these are believed to unite either by their edges and thus to form parietal placentations, or by the variable degree of their inflexion, to constitute either loculigerous or axile placentations; and from the evidence I shall be able to show, it will be evident that it is among the latter we must seek a place for the *Icacinaceæ*. But I have suggested the existence of several families, now distributed unsatisfactorily in different parts of the system, where we must imagine the placentæ to have originated, not from the *margins* of carpellary leaves which in such cases may be considered as sterile, but where their ovuligerous development is to be traced from the more basal or petiolar portions of the carpellary leaves: under this point of view, we may reconcile the idea of the original formation of an ovarium, which, though constituted of several carpels, will sometimes be unilocular, and at other times often incompletely plurilocular at the base, while in every instance they are all invariably 1-celled at the summit, the ovules being always attached to an erect placenta arising from the base of the cell, and completely unconnected with the style. This extensive group I have proposed to associate together in a distinct class, the *Cionospermæ* (*huj. op.* p. 8).

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* One of these, *Ptychopetalum,* was placed here, because its ovules were stated to be attached to a parietal placenta; but having since had an opportunity of examining it, I find it to possess the general characters of the *Olacaceæ.*

It will be in vain to urge, that there exists only a slight difference in the structure of the plurilocular ovarium with axile placentation, and the one-celled ovary with central placentation: this has been contended by several able botanists, who have argued that in such cases the dissepiments have been originally complete, but that by their attenuation they have broken away, until they have left the placentary column free. I do not deny that under certain circumstances this sometimes happens, but in these cases we can always trace the indications of such rupture, and we also invariably find, that the axile column, rendered thus free in the middle, is always attached by its summit to the style. On the other hand, in *Myrsinaceæ*, we cannot discern any indication of parietal expansion, or the smallest involution of what we may conceive to have been the sterile margins of the carpellary leaves; we find there the ovules often crowded around a free globular placenta, rising but little above the base of the cell, and springing directly from the pedicel of the flower: here, at least, we have fair evidence, that both placentæ and ovules must have proceeded from an immediate expansion of the elementary petioles of the original carpellary leaves. We perceive indeed, among the *Cionospermæ*, a gradual deviation from this extreme, beginning with slight parietal rudiments of sterile dissepiments, about the base of the cell, and varying in degree, until we reach the oppositely extreme cases of the *Styraceæ* and *Humiriaceæ*, where the ovarium is many-celled, even to the apex; but even here, in spite of the converging and always thickened incomplete dissepiments, extending so far, as even almost to touch the central expansions, we find the ovuligerous placentæ in the axis, always quite free from them, and from the style. If no original difference is to be found in the nature of the development, between the plurilocular germen, and the one-celled ovarium with free central placentæ, or if the existence of the latter were due to the breaking away from the placentæ of the inflected portions of the dissepiment so formed, we should sometimes perceive in the same order, the same genus, or even in the same individual, some instance where this had happened in a greater or less degree, and we should often meet with the two structures confounded; but we find invariably an equally uniform amount of development, proving that in their normal origin they are distinct.

It was upon these views I drew the conclusion and offered as the most probable suggestion (*huj. op.* p. 27) that the nearest affinity of the *Icacinaceæ* is with the *Celastraceæ*, or the *Aquifoliaceæ*, but that they differ from these in many essential respects, and cannot be held to be subordinate to either of them. With those who think it tends to the simplicity of the science, to diminish to the utmost possible extent the present number of natural orders, the *Celastraceæ*, *Aquifoliaceæ*, *Icacinaceæ*, *Hippocrataceæ* and some others might be considered as suborders of one large family; but I do not perceive any advantage in this method; for it matters little whether such divisions be called classes and orders, or orders and suborders; for were such an order established (under the name, for instance, of the *Dryaceæ*), it is clear that, in practice, any plant traceable to such alliance would always be referred to its own peculiar suborder and never to such family. I therefore incline to the greater convenience of retaining each group as hitherto established, as a distinct order, and combining the whole in a class that may be called the *Dryales**, because they mostly consist of trees with evergreen leaves. They cannot consistently be retained in the class of the *Frangulaceæ* of Endlicher, which are marked by other very different characters.

The group of the *Dryales* will hence consist mostly of evergreen trees with alternate, rarely opposite, exstipulate leaves which are generally coriaceous, entire, or slightly toothed; symmetrical flowers mostly hermaphrodite, often polygamous; calyx small, campanulate, toothed, free, or sometimes conjoined with the ovarium by the intervention of a fleshy disk; stamens generally equal in number to the petals, and then always alternate with them, usually five, rarely fewer, and often arising from a conspicuous disk; ovarium 5-locular, often by abortion only 3-, 2- or 1-celled; ovules anatropal, often resupinated, generally two in each cell, attached by a cupshaped podosperm to the axis or dissepiment, and either erect, horizontal, or suspended; seeds often solitary in each cell, frequently with a conspicuous arillus; embryo orthotropal, albuminous, or rarely exalbuminous, with the radicle pointed towards the hilum.

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* From δρῦς, *arbor sempervirens.*

The families that at present appear to constitute this group may be distinguished from each other by the following leading characters:—

Æstivation of Corolla.	Stamens in number to petals.	Disk.	Ovules.	Seeds.	Embryo.	Family.
imbricate.	equal.	present.	erect or ascending.	albuminous.	with large foliaceous cotyledons.	Celastraceæ.
,,	,,	,,	suspended.	,,	short with small cotyledons.	Aquifoliaceæ.
,,	fewer.	,,	horizontal.	exalbuminous.	fleshy with thick or foliaceous cotyledons.	Hippocrataceæ.
unknown.	equal.	,,	suspended.	,,	fleshy.	Chailletiaceæ.
valvate.	equal.	rarely obsolete.	,,	albuminous.	either small or large foliaceous cotyledons.	Icacinaceæ.
imbricate.	,,	none ?	,,	,,	small cotyledons.	Cyrillaceæ.

The *Icacinaceæ* may be thus defined. Trees or shrubs with alternate entire petiolate leaves, generally more or less coriaceous, smooth, exstipulate. Flowers hermaphrodite, or polygamous by abortion, generally very small, and very simple and symmetrical in their structure: inflorescence axillary or terminal, fasciculate or in many-flowered cymes or branching panicles, each flower distinctly articulated upon a short bracteated pedicel; bract minute, either very caducous, or abortive. Calyx usually small, cupshaped, 5-, rarely 4-toothed, persistent. Corolla hypogynous, consisting of 5, rarely 4 petals, alternate with the teeth of the calyx, always distinct, though often connivent at base into a tubular form by the slight adhesion of the filaments, more or less linear, of fleshy texture, valvate in æstivation, with the apical points inflected, reflexed and deciduous. Stamens equal in number to the petals, always alternate with them, and nearly equal to them in length; filaments erect, often implicated, fleshy, compressed, subulate, sometimes invested with glandular hairs; anthers introrse, 2-lobed, 2- or 4-celled, cells dehiscing lengthways by a cleft along one of their margins, rarely otherwise. Ovarium entirely free, supported upon a cup-shaped disk (which is either quite free or partially adnate with it), fleshy, oblong-conical, often surmounted with a conspicuous fleshy epigynous gland, which is sometimes lateral, generally by abortion 1-locular, sometimes 3-locular, and then the cells are excentrically disposed, showing the normal number of united carpels to be 5: ovules geminate, somewhat collaterally suspended, one a little higher than the other, from near the summit of the cell, by a short fleshy podosperm, which is generally expanded in the form of an inverted cup, anatropal, and sometimes resupinate. Style erect, or incurved, somewhat excentrical, as long as the stamens, sometimes wanting. Stigma generally clavate or obsoletely lobed. Drupe baccate, containing a single 1-celled, indehiscent putamen; seed single, filling the cavity of the cell, and apparently resupinate; testa thin and somewhat membranaceous, raphe arising from the nearly basal chalaza and extending to the summit along the dorsal face. Embryo in the axis and summit of fleshy and copious albumen, sometimes much shorter, and almost terete, with small oval cotyledons scarcely longer and broader than the superior radicle; but often nearly the length of the albumen, with large, ovate, foliaceous cotyledons, much longer and broader than the short terete superior radicle.

The affinity of the *Icacinaceæ* is evidently nearest to the *Aquifoliaceæ* and the *Celastraceæ*, differing from both in the æstivation of the corolla and the tenuity or frequent obliteration of the hypogynous disk. From the latter family they are distinguishable by their suspended ovules and their generally unilocular ovarium, and the absence of an arillus about the seed. The seminal characters have been derived from examinations of the seed of several species of *Mappia*, and confirmed by the few details furnished by the 'Icones' of Dr. Wight in tab. 1153 of *Apodytes*, and tab. 934 of *Stemonurus* (*Gomphandra*). I have little hesitation in concluding that the genus *Pennantia*, which has been placed by botanists in many different positions, belongs to this group, and from this source I am enabled to add many additional features which will probably be found to exist in the structure of other genera of this family.

I propose to divide the order into three tribes.

1. *Icacineæ*. In all the genera composing this tribe, the ovarium is constantly unilocular in consequence of the complete abortion of the other cells, hence it is always somewhat gibbous and the style is distinct and in some degree lateral: the anthers

are 2-lobed and 4-celled. This tribe will consist of the genera *Icacina, Apodytes, Rhaphiolepis, Mappia, Desmostachys, Leretia,* and *Poraqueiba.*

2. *Sarcostigmeæ.* These differ from the preceding tribe, in the absence of a more or less elongated style: here the true style, seen only in a young state of the ovarium, consists in a broad, depressed, conical and more or less hollow process, having a very small apical aperture, which is terminated by 4 or 5 extremely minute stigmatic teeth: with the growth of the ovarium, this assumes a more fleshy, broader, and more discoid appearance, and the stigmatic teeth become less visible, the whole soon taking the form of a depressed, 4–5-lobed, sessile stigma. The ovarium and fruit, in their structure and development, resemble what is seen in the former tribe; the stamens are also equal in number, and alternate with the petals, and the anthers are likewise 2-lobed and 4-celled. This tribe will consist of *Pennantia, Stemonurus, Sarcostigma, Discophora,* and probably also *Phlebocalymna.*

3. *Emmoteæ.* This at present is only represented by a single genus, *Emmotum* of Desvaux, which is certainly identical with *Pogopetalum* of Bentham, and which differs from all the others in its plurilocular ovarium, and the singular structure of its anthers, which are 2-lobed,and consist of 2 unilocular, evalvate and boat-shaped pollen-cells attached to a cordate and apiculate connective, fixed extrorsely upon the reflexed point of the filaments in the sinus of its anterior face, the pollen escaping by the splitting of the dorsal margin of each valve from the posterior surface of the connective, along the whole line of its attachment; they vary also in having an ovarium with three cells laterally placed in the manner before mentioned. These peculiarities, so very opposite in character to the features we invariably meet with in the other tribes, very naturally suggest a doubt as to the propriety of retaining this genus in the order; but no satisfactory conclusion on this head can be entertained, until some information be obtained respecting the structure of the fruit and seed.

I take this opportunity of remarking, that I have lately examined with attention the features of several genera newly proposed and described by Prof. Blume, in his 'Mus. Lugd. Bat.,' and referred by him to the *Olacaceæ.* Among them is *Nothapodytes* (*loc. cit.* p. 248), which will be seen to conform in all respects with *Mappia* (Jacq.), a genus shortly to be described at length. The characters given of his *Pleuropetalum* (*loc. cit.* p. 248), by the same distinguished author, will easily be recognized as those of *Bursinopetalum* of Dr. Wight, placed by that eminent botanist in *Olacaceæ,* but which I have shown must be referred to *Aquifoliaceæ,* it being nearly allied to *Villaresia*: having to describe in the sequel some new species of both these genera, I will then take an opportunity of pointing out the identity above mentioned. *Anacolosa* was first proposed as a second section of his genus *Stemonurus* by Dr. Blume in his 'Bijdr.' p. 648: more recently, he has with ample reason elevated it to the rank of a separate genus (*loc. cit.* p. 250), with the important addition of analytical details of its structure, in tab. 46 of the same work. The facts there demonstrated prove beyond doubt, that they must constitute not only very distinct genera, but that they must be referred to different families. *Anacolosa* will consequently find its place among the *Olacaceæ,* and it is rendered more interesting, as bearing considerable resemblance in some of its characters to *Cathedra* (*huj. op.* p. 9) with which genus, the *Diplocrater* of Mr. Bentham (Hook. Kew. Misc. iii. p. 367) will be found to be identical. *Stemonurus,* as an unquestionable member of the *Icacinaceæ,* will therefore be shortly investigated here. The genus *Platea* of the same botanist, first proposed in his 'Bijdragen,' and of which more ample generic details are given in his 'Mus. Lugd. Bat.' p. 249, appears to me to differ in few essential respects from *Stemonurus*: the stamens in this last-mentioned genus vary considerably in length, not only in different species, but often in the same individual, according to the age of the flowers; the number and length of the villous hairs that clothe the summits of the filaments are not less variable; in some cases these hairs are almost obsolete and scarcely discernible, so that the stamens are reduced to the state of those described in the male flower of *Platea,* which differs in no other respect from *Stemonurus*: the female flowers also agree in all essential points with those of the genus last-mentioned, where, owing to the extremely caducous disposition of the petals and stamens, we often find, in several species of *Stemonurus,* just what is described in the character of *Platea.* As *Lepionurus* does not belong to the *Icacinaceæ,* I shall defer making any observation on that genus, until we come to treat of the genera of the *Olacaceæ.*

ICACINA.

This genus, which, as the first discovered, may be considered as the type of the family to which it belongs, was founded by Adr. de Jussieu in 1823, upon a plant from Senegal, bearing much the habit of *Chrysobalanus Icaco,* whence the derivation of its generic name. It was arranged by DeCandolle in his 'Prodromus,' i. 534, as a genus "*Olacineis* affine," and subsequently was placed in the same family by Mr. Bentham, as the type of his tribe *Icacineæ.* I may here remark, that in the young state, the stigma is distinctly 3-cleft, and the style is short, erect and straight as in *Mappia*; it is owing to its elongation while yet in bud, that it becomes incurved, and to pressure against the petals, that its stigma becomes obsoletely lobed. It is the only species hitherto described, for the *Icacina dubia* of M^{c}Fadyen will be shown to be the *Mappia racemosa* of Jacquin. Three other species will, however, be added below. The generic character may be thus given.

ICACINA, A. Juss.—*Flores* perfecti. *Calyx* breviter campanulatus, 5-dentatus, dentibus acutis, persistens. *Petala* 5, oblonga, intus villosa, extus sericea, hypogyna, æstivatione valvata, sub anthesi patentia, imo adhesione filamentorum in tubum brevem conniventia. *Stamina* 5, cum petalis inserta, iisdem alterna; *filamenta* carnosula, imo dilatata, apice subulata, et breviter induplicata; *antheræ* ovatæ, introrsæ, 2-lobæ, 4-loculares, imo ad medium bifidæ, connectivo tenui adnatæ, dorso in sinu affixæ, lobis singulatim 2-locellatis, demum septicidis et longitudinaliter evolutim* dehiscentibus. *Pollen* acute 3-gonum. *Ovarium* liberum, oblongum, sub-gibbum, villosum, disco parvo suffultum, 1-loculare; *ovula* 2 juxta apicem loculi subcollateraliter superposita, podospermio crassiusculo suspensa, anatropa. *Stylus* elongatus, subulatus, sulcatus, incurvus. *Stigma* obliquum, obsolete lobatum, lateraliter excavatum. *Drupa* villosa, monopyrena, 1-locularis, monosperma; cætera ignota.—Arbores *in Africam tropicam vel in Insulas vicinas crescentes*; folia *alterna, ovata, integra, coriacea, petiolata, exstipulata*; inflorescentia *paniculata, terminalis*; flores *parvuli, cum pedicellis brevibus articulati,* bracteolis *minimis, caducis.*

1. *Icacina Senegalensis,* Ad. Juss. Mem. Soc. Hist. Nat. i. 173. tab. 9; DC. Prodr. i. 534; Guill. Perr. Tent. Fl. Seneg. i. 105. Chrysobalanus luteus, *Sab. Trans. Hort. Soc.* iv. 453; —foliis ovatis basi rotundatis a medio acuminatis et apice obtusis, vel rotundatis et retusis, reticulatis, coriaceis, utrinque glaberrimis, supra sub-lucidis, subtus ferrugineis, petiolo brevi crassiusculo canaliculato: floribus terminalibus, laxe paniculatis, pedicellisque articulatis rufescenti-villosis; drupa flava. —Senegambia; *v. s. in herb. Hook.* (Heudelot).

The figure above quoted of Jussieu gives a very good representation of this plant, and the specimen in Sir Wm. Hooker's herbarium agrees very well with it, except that the leaves are generally more rounded at the summit, and deeply emarginated; but it agrees in all its other characters. The leaves are 3½ inches long, 2¼ inches broad, on a petiole scarcely 2 lines in length; the internodes are 1 inch distant, and the raceme is 2 inches in length, on the elongated termination of the branch.

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* I shall continue to use this term to prevent a repetition of the following mode of dehiscence, which I find nowhere described, although it is of frequent occurrence: it differs essentially from the longitudinal or valvate opening of the ordinary simple cell, in the same manner that the septicidal dehiscence of a capsular fruit does from its loculicidal mode of opening. The structure of its 2 lobes and their manner of dehiscence may be further defined—lobæ introflexione marginum contiguorum singulatim parallele et perfecte 2-locellatæ, marginibus istis primo solutis, valvulis tunc contrarie evolutis; dein apparet ut si lobæ ambæ 1-loculatæ fuerint, et per rimam longitudinalem dehiscerint.

2. *Icacina Mauritiana*, n. sp.;—arbor 7-orgyalis, ramulis glabris foliis oblongis, utrinque acutis, apice acuminatis, glaberrimis, subtus ferrugineis, margine revolutis, petiolo subtenui; panicula terminali folio longiore, pluriflora, ferrugineo-pubescente, floribus albis, odoratissimis.—Mauritius; *v. s. in herb. Hook.*

This is a tree 40 feet in height, growing near "Colville Bridge"; its leaves are 2½ inches long, 1⅛ inch broad, on a somewhat slender petiole half an inch in length; its terminal panicles are about 2 inches long. It appears to me referable here, rather than to *Apodytes*, because of the induplicated apex of its filaments, and the form of its anthers, which are shorter, more ovate, and less bifid than in that genus.

3. *Icacina grandifolia*;—foliis cuneato-oblongis, apice obtusis, infra medium attenuatis, utrinque glaberrimis, concoloribus, multinerviis, margine undulatis, petiolo brevi crasso canaliculato; panicula terminali laxe ramosa, ramis longe nudiusculis, apice floriferis, multiflora, folio longiore.—Madagascar; *v. s. in herb. Hook.* (Lyall).

This is a very distinct species, remarkable for the large size of its leaves, which are 6 inches long, 2½ inches broad, on a petiole only ¼ of an inch in length; the terminal panicle is 8 inches long, with its virgate branchlets 4 to 5 inches in length, which are ramified towards their extremity and bear numerous small pubescent flowers*.

APODYTES.

The characters of this genus, suggested by Dr. Meyer, were first published by Dr. Arnott in 'Hooker's Journal of Botany,' and nearly about the same time by Mr. Bentham, in a memoir given in the 18th vol. of the 'Linnæan Transactions.' The principal feature by which it is distinguishable from *Icacina*, is the subsequent growth of its ovarium into a form so extremely gibbous, that the style appears as if it were produced upon one side, where it is inflected downwards, and at maturity this is rendered manifest by the presence of a somewhat lateral scutelliform appendage, towards the summit of the fruit. It is however to be remembered, that nothing is yet known of the development of the ovarium of *Icacina*, beyond its early stage, when it exactly resembles that of *Apodytes*; and it is not at all improbable, that in the respect just mentioned, they may turn out to be alike, in which case the two genera must be regarded as identical, and all the species of *Apodytes* must then be referred to *Icacina*. I have had no opportunity of examining the seed of *Apodytes*, and in the following diagnosis have therefore added its carpological characters from the description of Mr. Bentham, which will be seen to conform with the analysis given by Dr. Wight, in his 'Icones,' tab. 1153. The only other tangible feature that can serve to distinguish these genera, is, that in *Icacina* the anthers are ovate, not long, linear, and profoundly bifid below, and that the filaments are slightly induplicated at their apex, not straight, as in *Apodytes*.

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* A drawing of this species with generic details will be given in plate 4 of this work.

Apodytes, E. Meyer; Arnott, Hook. Journ. Bot. iii. 155; Benth. Linn. Trans. xviii. 683.—*Flores* perfecti, vel interdum polygami, sicco nigrescentes. *Calyx* parvus, 5-dentatus, persistens. *Petala* 5, linearia, carnosula, glabra, hypogyna, æstivatione valvata, demum patentia. *Stamina* 5, cum petalis inserta, iis alterna, et fere æquilonga: *filamenta* compressa, subulata, erecta; *antheræ* lineari-oblongæ, 2-lobæ, basi ad medium bifidæ, in sinu dorsifixæ, sæpe glandulis resinosis asperæ, lobis parallelis, connectivo tenuissimo connatis, singulatim 2-locellatis, demum septicidis et longitudinaliter evolutim dehiscentibus. *Pollen* trigonum. *Ovarium* liberum, oblongum, valde gibbum, disco parvo suffultum, 1-loculare; *ovula* 2 juxta apicem loculi subcollateraliter superposita, podospermio crassiusculo suspensa, anatropa. *Stylus* elongatus, subulatus, flexuosus. *Stigma* clavatum, sub-3-lobum. ("*Drupa* baccata, dimidiato-ovato-reniformis, stylo hinc coronata, et lateraliter appendice carnoso aucto, nucleo osseo monospermo. *Semen* pendulum, ovato-reniforme, compressum, *testa* tenui, *albumine* copioso, carnoso, nigro. *Embryo* in medio albuminis parvus, axilis, juxta hilum positus, rectus, *radicula* breve ad hilum spectante." Benth. *loc. cit.*)—Arbores *capenses et Asiaticæ*, folia *alterna, ovata, integra, coriacea, glabra, petiolata*. Inflorescentia *paniculata, terminalis*; flores *parvuli, cum pedicellis brevibus articulati*, bracteolis *minimis, caducis*.

1. *Apodytes dimidiata*, E. Mey.; Arnott, Hook. Journ. Bot. iii. 155; Benth. Linn. Trans. xviii. 684;—ramulis sulcato-angulatis, junioribus pubescentibus; foliis ovatis vel oblongis, acutis vel retusis, coriaceis, supra glaberrimis, subtus pube

rara conspersis, margine cartilagineo revolutis, petiolo subbrevi, canaliculato; paniculis axillaribus et terminalibus, valde ramosis, creberrime floribundis, antheris linearibus, profunde bifidis, crustaceis, glanduloso-echinatis, ovario flavide sericeo. —C. B. S. ad Krakakamma, Prov. Uitenhage (Zeyher, Drège, Harvey); Port Natal (Krauss, 95).

The different specimens vary in the size and shape of the leaves, and in their more or less glaucous or pruinose hue; they are generally from 1½ to 2¼ inches long, ¾ to 1 inch broad, on a petiole of 3 lines in length.

Var. *β. capensis*;—foliis utrinque acutioribus, glauco-pruinosis, glaberrimis, crasso-coriaceis, margine cartilagineo revolutis, petiolo quam præcedenti duplo longiore et tenuiori, subscabrido.—C. B. S. (Masson); Uitenhage (Drège).

I can hardly affirm this to be a distinct species, although it is very different in its aspect, and remarkable for the much greater length of its petioles; the leaves are more glaucous, thicker, and more coriaceous, upon petioles twice as long, with longer, spreading, terminal panicles and very copious flowers: the leaves measure generally 2 inches in length, 1 inch in breadth, upon a petiole of 7 lines long.

2. *Apodytes Benthamiana*, Wight, Icones, tab. 1153;—ramulis teretibus, glabris; foliis oblongo-ellipticis, utrinque obtusis, coriaceis, glaberrimis; panicula terminali, rigida, folio breviori, alabastris oblongis, floribus albidis; drupa ovata, appendice laterali scutiformi signata.—Neilgherries.

Dr. Wight describes this to be a tree, with leaves from 3½ to 4 inches long, including the petiole, and 1½ inch broad: the flower-buds 3 lines long: the drupe is represented as 8 lines long, and 6 lines in diameter, semi-ovate, reniform, crowned with the persistent style, and furnished with a lateral scutelliform appendage. The leaves and flowers of this and the following species become dark in drying, and appear to be charged with resinous matter.

3. *Apodytes Gardneriana*, n. sp.;—foliis sicco nigrescentibus, oblongis, utrinque acutis, acuminatis, apice barbato obtuse mucronatis, subcoriaceis, glaberrimis, supra lucidulis, nervis immersis, subtus ferrugineo-brunneis, nervis prominulis rubentibus, margine valde revoluto; panicula sublaxa, terminali, alabastris elongatis, minoribus.—Ceylon, ad Newer-Ellia, altit. 6000 ped. (Gardner, n. 189).

This species hardly accords with Dr. Wight's description of the Neilgherry plant, and the specimens from the two localities differ much in appearance: the leaves here are larger, being 4¼ inches long, or with the petiole 4¾ in length, and 2¼ inches broad; the panicle is 1¾ inch long, the flowers grow black in drying, and the buds scarcely exceed a line in length*.

4. *Apodytes acutifolia*, Hochst.;—arbor grandis, ramulis substriatis, glanduloso-verrucosis, foliis ovatis, utrinque acutis, apice repente et breviter attenuatis, glaberrimis, supra sublucidis, subtus pallidioribus, petiolo valde elongato, tenui, canaliculato, glabro, glauco; panicula laxe ramosa, terminali, folio breviore, pauciflora, sparse pubescente.—Abyssinia, in Monte Aber, prope Adesselam altit. 8000 ped.—*v. s. in herb. Hook. et Mus. Brit.* (Schimper, 1315).

This is said by Schimper to be a tall handsome tree: its branchlets are marked with long whitish spots having a furrow down the middle; the leaves are 3½ inches long, 1¾ inch broad, upon a petiole 1¼ inch in length: the panicle measures 1¾ inch.

RHAPHIOSTYLIS.

This genus, suggested by Dr. Planchon, was first announced by Mr. Bentham, who gave an outline of its characters in the 'Niger Flora,' p. 259. It differs little from *Apodytes*, its distinguishing features consisting in its inflorescence, with small axillary fasciculate flowers, and the peculiar somewhat lateral glandular appendage, seen on the summit of the ovary, and near the base of the style: it bears somewhat the appearance as if it had originally possessed three styles, one of which had acquired much growth, and the other two, being abortive, exhibited only rudimentary traces of their existence: on the other hand, this process is evidently very analogous to the fleshy scutelliform appendage seen in *Apodytes*, as well as to the large epigynous gland observed in the fruit of *Stemonurus*. In its elongated slender style (whence its generic name is derived) it has much resemblance to *Icacina*: in its inflorescence and habit, it bears greatly the appearance of the *Phlebocalymna* of Griffiths. The following outline of its generic character is somewhat modified from that given by Mr. Bentham, in order to distinguish it more readily from other genera of the same family.

RHAPHIOSTYLIS, Planch.; Bth. (Flor. Nigrit.)—*Flores* perfecti. *Calyx* breviter campanulatus, 5-dentatus, dentibus obtusiusculis, persistens. *Petala* 5, æqualia, linearia, glaberrima, hypogyna, æstivatione valvata, sub anthesi reflexa. *Stamina* 5, cum petalis inserta, iisdem alterna; *filamenta* carnosula, imo

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* A representation of this species with generic details is given in plate 5 of this volume.

dilatata, apice subulata; *antheræ* oblongæ 2-lobæ, 4-loculares, imo bifidæ, connectivo tenui, dorso in sinu affixæ, lobis singulatim 2-locellatis, demum septicidis, et longitudinaliter evolutim dehiscentibus. *Pollen* trigonum. *Ovarium* oblongum, liberum, subgibbum, glabrum, disco parvulo stipitatum, appendice glanduloso dentibus 2 obtusis erectis ad basin styli lateraliter coronatum, 1-loculare; *ovula* 2 juxta apicem loculi subcollateraliter superposita, podospermio crassiusculo suspensa. *Stylus* tereti-subulatus, gracilis, longitudine petalorum excedens, apice inflexus. *Stigma* obtusum, lateraliter sulcatum. *Fructus* ignotus.—Frutices *Africæ tropicæ glabri, exsiccatione nigrescentes*; folia *alterna, elliptica, integerrima,* flores *parvi, plurimi, axillares, fasciculati, cum pedicellis brevibus articulati.*

1. *Rhaphiostylis Beninensis,* Planch.; Hook. Flor. Nigrit. 259. tab. 28. Apodytes Beninensis, *Hook. fil. Icon. pl.* tab. 778; —glaberrimus, foliis distichis, elongato-ellipticis, utrinque attenuatis, summo obtusiusculo vel emarginato, subtus nervis prominulis, margine revolutis, breviter petiolatis: floribus axillaribus, paucis, virente-albidis, cum pedicellis sub-brevioribus articulatis.—Cape Palmas (Vogel).—*v. s. in herb. Hooker.*

The leaves here are 3½ to 4 inches long, 1⅛ inch broad, on a petiole of 2 lines; the axils are generally ¾ inch apart, with about eight flowers in each; the flowers in bud are 3 lines long, on a pedicel of 2 lines.

2. *Rhaphiostylis Heudelotii,* Planch. MSS.;—glaberrimus, foliis oblongo-ellipticis, utrinque acuminatis, apice repente angustatis, coriaceis, subtus pallidioribus, breviter petiolatis; floribus axillaribus, pedicellatis, e nodo crebre bracteato 8–10-fasciculatis.—Senegambia (Heudelot, 723: *v. s. in herb. Hook.*).

This is certainly a distinct species, the leaves being considerably larger than the former, more attenuated in the apex, paler, more coriaceous, the axils more distant, and the flowers larger. The leaves are 5½ inches long, 2 inches broad, on a petiole of 3 lines: the axils are 1⅝ inch apart; the flowers in bud measure 4 lines in length, and 1 line in diameter, upon pedicels 2 lines long; the pistil is at least a line longer than the petals; the calyx is very small: the whole plant is entirely glabrous, and like the former blackens in drying*.

LERETIA.

This genus, although previously known from the rough and very incorrect figure in the 'Flora Fluminensis,' was first

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* This species, with an analysis of its floral structure, is represented in plate 6 of this work.

described by Mr. Bentham in the 'Linn. Trans.' xviii. p. 680. It resembles his *Pogopetalum* in having its petals clothed inside with long silky hairs, and bears some analogy with *Rhaphiostylis* and *Pennantia* in exhibiting two erect processes about the base of the style, which in all these instances may be considered as additional and rudimentary styles, corresponding with as many abortive cells of the ovarium: this hypothesis is rendered the more probable by the fact, that in making a transverse section of the ovarium, these abortive cells may be distinctly traced in the fleshy covering, upon the side correlative with the stylar appendages. As in the other genera last mentioned, the suspension of the two somewhat collateral ovules is from a point below the apex, towards the side of the abortive cells, and they are here attached to a thick fleshy bell-shaped podosperm with a conspicuously crenated margin. The ovarium is densely covered with long adpressed erect hairs, which as well as those of the petals are thickly spotted with prominent, oval, transparent glands, arranged in closely spiral lines all over their surface. I did not meet with its fruit, nor have I found it in any herbarium, so that I cannot offer any particulars of its seminal structure; but in the figure of the 'Flora Fluminensis,' above referred to, this is represented as a large fleshy drupe, about 1½ inch in diameter, and therefore one of the largest known in this family. The *Emmotum fagifolium* of Desvaux, from Guiana, has been referred here by Endlicher; but, notwithstanding the scantiness of the details given of it, little doubt can exist that it is identical with the *Pogopetalum acutum*, Bth., also from Guiana.

LERETIA, Velloz.—*Flores* perfecti, interdum polygami. *Calyx* breviter campanulatus, acute 5-dentatus, persistens. *Petala* 5, æqualia, hypogyna, oblonga, carnosula, extus pubescentia, intus dense sericea, æstivatione valvata, sub anthesi reflexa. *Stamina* 5, cum petalis disco inserta, iisdem alterna; *filamenta* carnosula, basi dilatata, apice subulata et breviter induplicata; *antheræ* oblongæ, apice mucronatæ, imo breviter bifidæ, 2-lobæ, connectivo tenui dorso infra medium sinu affixæ, lobis bilocellatis, membranaceis, demum septicidis et longitudinaliter evolutim dehiscentibus. *Pollen* ovale, longitudinaliter 3-sulcatum. *Ovarium* conico-oblongum, subgibbum, sericeo-hirsutum, disco parvulo obsolete 5-lobo breviter stipitatum, 1-loculare; *ovula* 2 juxta apicem loculi collateraliter superposita, *podospermio* crasso crenato suspensa. *Stylus* erectus, filiformis, apice inflexus, basi processubus 2 brevibus erectis comitatus, in flore sterili valde brevior, hirsutus et obtusus. *Stigma* obliquum, sulcatum. *Drupa* majuscula, globosa, monosperma; *cætera* ignota. Arbuscula Brasiliensis *in sylvis* *maritimis vigens,* ramulis *glanduloso-rugosis, acute angulatis, angulis ab axillis utrinque decurrentibus* : folia *alterna, oblonga, glaberrima, subcoriacea, reticulata, minute pellucido-punctulata, læte viridia, sicco pallescentia, breviter petiolata* ; panicula *laxa, axillaris, divaricatim ramosa,* floribus *cum pedicellis brevibus articulatis, pubescentiæ pilis punctato-glandulosis.*

1. *Leretia Vellozii.* L. cordata, *Velloz, Flor. Flum.* iii. tab. 2 ;—ramulis angulatis, cortice rimoso, foliis oblongis, utrinque subacutis, apice breviter attenuatis, coriaceis, nervosis, margine revolutis, petiolo brevi crasso canaliculato; panicula pubescente, floribus extus griseo-pilosulis, intus pilis longissimis ferrugineo-sericeis dense vestitis: drupa majuscula, globosa.—Rio de Janeiro in sylvis maritimis.—*v. v.*

I collected specimens of this plant in 1836 in a wood on the borders of Jurujuba Bay, in the harbour of Rio de Janeiro : it was found also by Gardner on the maritime skirts of the Corcovado range at Tejuco, and by Padre Velloz in the maritime woods at Tagoahy, in the same province: the specimens collected by Moricand in Ilheos, no. 2347, do not appear to me to differ specifically from the others. It forms a tree with spreading branches, of which the branchlets are acutely angular as above described. Its leaves are 6 inches long, $2\frac{1}{2}$ inches broad, on a petiole $\frac{3}{8}$ of an inch in length : the panicle is from 2 to 3 inches long, with its branches spreading at right angles to the length of $1\frac{1}{2}$ inch : the flower-bud is oval, 2 lines in length; the petals are of a greenish yellow colour, clothed inside with long white silky hairs, which become brown in drying: the ovarium is in like manner sericeous, so that the lower half of the style, and its basal lobes, are concealed. As the name *cordata* may lead to mistake, there being nothing in the form of its leaves or other parts approximating a heart-shape, I have dedicated the species to the author of the genus ;—the somewhat truncated base of the kernel of the fruit (probably an accidental occurrence) suggested the above designation*.

MAPPIA.

This genus, described and figured in the 'Hortus Schœnbrunensis' by Jacquin in 1797, appears to have escaped the notice of all succeeding botanists. The plant upon which it was founded was raised in the Imperial Botanic Garden, but the country from which it was derived was then unknown. There can be no doubt, however, that it is identical with the *Icacina dubia* of McFadyen, and that it is a native of Jamaica. I have also to add many other species from tropical Asia, and Madagascar, so that the range of the genus is considerable. In its floral structure it is very near *Icacina*: it differs from *Apodytes, Rhaphiostylis* and *Leretia,* in the absence of any glandular appendage or raised teeth on the summit of the ovarium, and from both, as well as from *Icacina,* in having a shorter, erect, and stronger style, and a lobed hollow stigma, in its calyx being more entire, the anthers more ovate and not so deeply cleft at base, and in its entirely free hypogynous disc, smooth outside and generally very pilose within: in the cristulate apex of the nut, it bears some analogy with that of *Pennantia.* It differs from *Apodytes* and *Pennantia,* but agrees with *Stemonurus* in its larger embryo, with large, oval, foliaceous cotyledons, that nearly equal the length of the albumen. It is the *Stemonurus* of Dr. Wight, but differs essentially from the *Stemonurus* of Blume.

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* This plant, with full generic details, is shown in plate 7 at the end of this volume.

The *Nothapodytes* of Blume agrees with this genus in every essential feature. I cannot perceive any difference in the structure of the flowers between the Jamaica and Asiatic species, except in the more glabrous habit of the former, their more lanceolate leaves, and the perfect smoothness of the hypogynous disc, features that cannot constitute any generic distinction. I have therefore divided them into corresponding tribes.

The following outline of its generic characters has been derived from my own observations.

Mappia, Jacq. Stemonurus, *Wight, non Bl.* Nothapodytes, *Bl.* —*Flores* perfecti, interdum polygami. *Calyx* breviter campanulatus, fere integer, denticulis 5 donatus, immutatus et persistens. *Petala* 5, oblonga, carnosula, intus villosa, imo disci inserta, æstivatione valvata, sub anthesi patentia. *Stamina* 5 cum petalis inserta, iisdem alterna; *filamenta* basi dilatata, carnosula, superne subulata, æstivatione induplicata; *antheræ* introrsæ, ovatæ, 2-lobæ, 4-locellatæ, imo breviter bifidæ, *connectivo* tenui, dorso in sinu affixæ, lobis singulatim 2-locellatis, demum septicidis, et longitudinaliter evolutim dehiscentibus. *Pollen* reticulatum, 4-sulcatum vel subquadratum. *Ovarium* liberum, ovatum, interdum subgibbum, villosum, imo glabrum, et disco cupuliformi libero margine lobato, extus glabro, intus sæpissime hirsuto hinc circumdatum, 1-loculare; *ovula* 2, juxta apicem loculi subcollateraliter suspensa, anatropa. *Stylus* teres, interdum brevis, erectus, rarius paullulo curvatus. *Stigma* erectum 2–5-lobum, cavum, demum capitatum. *Drupa* oblonga, epicarpio parco carnosa, olivæformis, ianthina, monopyrena, calyce persistente suffulta: *putamen* osseum, tenue, extus irregulariter sulcato-rugosum, crista apicali et laterali; *semen* suspensum, oblongum, *testa*

membranacea, raphe dorsali, ab apice versus basin tendens, *chalaza* fere basali: *embryo* in axi *albuminis* carnosi immersus, orthotropus, inversus, fere ejusdem longitudine, *cotyledonibus* majusculis, foliaceis, ovatis, *radicula* 3-plo longioribus.—Arbores *in Asia tropica, et Antillis crescentes,* folia *lanceolata, oblonga, aut ovata, acuminata, integra, subpubescentia, petiolata*; inflorescentia *paniculata, terminalis,* flores *parvuli, flavescentes, odore fœtido, rarius suaveolente emittentes, cum pedicellis articulati.*

§ 1. EUMAPPIA. Discus cupularis profunde et obtuse 5-lobatus, lobis extus 2-costatis, utrinque glaberrimis. *Species Antillanæ.*

1. *Mappia racemosa,* Jacq. Hort. Schœnb. i. 22. tab. 47. Icacina dubia, *McFad, Fl. Jam.* i. 122;—foliis lanceolatis, utrinque acutis, glaberrimis, nitidis, penninerviis, nervorum axillis glandula supra verrucæformi subtus cava signatis, petiolo longiusculo, glabro, canaliculato; paniculis axillaribus, folio brevioribus, plurifloris, floribus parvis, flavescentibus, odore fœtido, calyce glabro, denticulato, petalis extus lævibus, intus sericeis.—Jamaica; *v. s. in herb. Hooker* (*MacFadyen*).

The figure of Jacquin gives a very faithful representation of this plant, as well as good details of the structure of the flower. The fleshy immersed gland, about the size of a millet seed, seen near the axil of each nerve, offers a very characteristic mark of this species; its leaves are 4 inches long, 1¼ inch broad, upon a petiole of 6 or 8 lines: the panicle is 2½ inches long. The whole plant, as in some other species of this genus, becomes black in drying.

2. *Mappia affinis,* n. sp.;—ramulis lenticellis elongatis, verrucosis, albidis maculatis; foliis lanceolatis, basi minus acutis, glaberrimis, nitidis, penninerviis, nervis eglandulosis, petiolo breviori, canaliculato; paniculis glabris, axillaribus, folio multo brevioribus, multifloris, floribus parvulis, odore suaveolente, calyce subpubescente, petalis extus glabris, intus sericeo-pilosis.—Manchester, Ins. Jamaicæ; *v. s. in herb. Hook.* (*Purdie*).

This species is very similar to the foregoing one, but is distinguished by the want of the peculiar nerval gland and by the whole plant becoming less black in drying. Its leaves are 5½ inches long, 1½ inch broad, on a petiole half an inch in length: the panicle is 1½ to 2 inches long.

§ 2. TRICHOCRATER. Discus cupularis, 5-dentatus, extus glaber et 10-costatus, intus pilis longis indutus. *Species Asiaticæ.*

3. *Mappia fœtida.* Stemonurus fœtidus, *Wight, Icon.* tab. 955; *Spic. Neilgh.* tab. 23;—foliis ovato-ellipticis vel elliptico-ob-

longis, apice repente attenuatis, valde reticulato-venosis, utrinque parce pubescentibus, subtus glauco-pallidis nervis venisque prominentibus; paniculis terminalibus cymosis breviter pilosis; floribus subparvis, flavis, fœtidis, sæpe omnibus masculis; calyce acute 5-dentato; drupa olivæformi, purpurea, putamine tenui.—Neilgherries; *v. s. in herb. Hook.* (*Wight*).

This is described as a large umbrageous tree, and I observe the specimens do not become black in drying; the leaves are generally 4 or 5, sometimes even 7 inches long, usually 2, rarely 3 inches broad on a petiole $\frac{3}{4}$ inch in length: the panicle is from 2 to 3 inches long, much spreading, with numerous flowers; the buds are ovate, nearly 2 lines long, and the flowers, which exhale a rank smell of carrion, are larger than most of the species of this genus; the calyx is deeply and acutely dentate; the petals are very pilose outside, covered with sericeous hairs inside, and marked by a raised longitudinal nervure; the anthers are oblong, with a mucronulate apex; the ovarium and erect style are densely covered with long pilose hairs, but the former is glabrous at its base, where it is surrounded by a short free cup, which is quite smooth outside and densely sericeous within.

4. *Mappia oblonga*, n. sp.;—foliis oblongis, utrinque acutis, summo longiuscule attenuatis, supra glabris, nervosis, nerviis 7–9-jugis, venisque subtus sparse pubescentibus, petiolo elongato, gracili, glabro, canaliculato; panicula laxa, terminali, pubescente, folio dimidio breviori, divaricate ramosa, ramulis elongatis, floribus majusculis valde pilosis, calyce submembranaceo denticulato.—Bombay—Ghauts; *v. s. in herb. Hook.* (*Dalzell*).

The leaves of this species are 6 inches long, 3 inches broad, on a petiole 1$\frac{1}{4}$ inch in length; the terminal panicle measures 3 inches. A specimen in the Wallichian herbarium, no. 9064, under the name of "*Cordia*," is probably only a variety of this species: it is from Travancore, collected by Dr. Wight, and may be thus designated:—

Var. *elliptica*, ramulis angulatis, foliis minoribus, ellipticis, basi obtusioribus, apice breviter attenuatis.

5. *Mappia ovata*, n. sp.;—ramulis glabris angulatis; foliis ovato-oblongis, basi inæquilateribus, apice subito attenuatis, fere glabris, supra nitidis, læte virentibus, creberrime reticulatis, venosis, subtus glaucis et resinoso-punctatis, margine subrevolutis, nervis venisque utrinque sparse pubescentibus, subtus in axillas venarum barbatis, petiolo gracili, valde elongato, glabro; panicula subterminali, floribus parvis, pubescentibus;

calyce 5-dentato.—Ceylon—Hautane, altit. 2300 ped.; *v. s. in herb. meo et Hook.* (*Gardn.* 99).

This is a very distinct species; the branchlets appear fistulose and angular; the leaves are broader than other species, being 6½ inches long, and 4 inches broad, on a petiole of 2 or 2¼ inches; the panicle, on a lengthened peduncle, does not exceed 2 inches in length; the flowers are small, and densely tomentose*.

6. *Mappia Gardneriana,* n. sp.;—foliis oblongis, basi obtusis et inæquilateribus, apice subito attenuatis, margine subrevolutis, supra fere glabris, subtus ferrugineo-glaucescentibus, et parce pubescentibus, punctis creberrimis minutis notatis, nervis 8-jugis supra impressis, subtus prominentibus, fuscis, pilosulis, petiolo elongato, canaliculato; panicula subterminali, pilosa, pedunculo crassiusculo, petalis intus pilis dense vestitis, calyce denticulato.—Ceylon—Newer Ellia, altit. 6000 ped.; *v. s. in herb. meo et Hook.* (*Gardn.* 98), Galagama (*Thwaites,* no. 492).

This species greatly resembles *M. fœtida*; the nervures of the leaves are sometimes a little barbate at base. The leaves are 5½ inches long, 2¾ inches broad, on a petiole of 1 or 1¼ inch in length. It is one of the commonest plants of Ceylon, and called by the natives *Ganda pang,* meaning "stinking lamp," on account of the extremely fœtid odour of its flowers.

7. *Mappia Championiana,* n. sp.;—cortice suberoso, foliis oblongis, apice attenuatis, costæ summo imoque recurvis hinc subconduplicatis, textura tenuibus, utrinque sparse pubescentibus, subtus pallide flavidis, nervis paucijugis prominentibus et rufulis, reticulato-venosis, venulis in areolis liberis et furcatis: panicula cymoso-terminali, longe stipitata, 2–3-chotome ramosa, ramis elongatis gracilibus, floribus crebris dense pilosis, odore fœtidis; drupa ovali, putamine rugoso.—Ceylon; *v. s. in herb. Champ. et Hook.* (Col. Walker, Major Champion).

The leaves in this species are 4½ to 7 inches long, 2¼ to 3 inches broad, on a petiole ¾ to 1 inch in length. It is certainly different both from the *M. Gardneriana* and *M. fœtida,* having leaves of much thinner texture, beautifully reticulated, and with fewer nervures, these scarcely exceeding 5 pairs: its flower stem and branchlets are much more slender: on account of the fœtid odour of its flowers, it also bears the vernacular name of *Ganda pang.*

8. *Mappia Wightiana,* n. sp.;—foliis lanceolato-oblongis apice subito attenuatis, a medio ad basin gradatim angustioribus textura tenuibus, utrinque glabris, subtus glaucescenti-pallidis,

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* A figure of this species, with ample generic details, will be seen in plate 8 of this work.

nervis rufulis, eleganter reticulatis, venulis in areolis liberis et furcatis, margine revolutis, petiolo gracili canaliculato, costaque sparse pubescentibus: panicula terminali dichotome ramosa, sparse pubescente, floribus adpresse pilosis, calyce brevissimo, denticulato, hirsuto, disco intus longissime hirto.—Madras; *v. s. in herb. Hook.* (Wight, 'Beureria?' no. 647).

This is certainly a very distinct species, and bears much analogy with the preceding: it is distinguishable by the shape and greater length of its more flattened leaves, which are almost membranaceous in texture, their reticulations being regularly anastomosed like the fronds of some ferns; the leaves are 7 to 8 inches long, 3 inches broad, on a petiole 1⅜ in length; the raceme is 3 inches long; the flowers are remarkable for the greater rigidity of the pubescence, for the small size of their hirsute calyx, and for the length of the rigid hairs that spring from the internal face of the cupular disk, which form a close erect crown, concealing more than half the ovarium.

9. *Mappia tomentosa*, n. sp.;—foliis oblongis, basi obtusis, apice acuminatis, vix attenuatis, coriaceis, supra glabriusculis, nervis 8-jugis, subtus demissu fulvo-tomentosis, rachi versus basin valde prominenti, petiolo crasso, canaliculato, tomentoso; panicula terminali, tomentosa, multiflora, ramo ramulisque crassis, pedicellis confertis, cum floribus articulatis; drupa sanguinea pilosa, majuscula, pulposa, putamine rugoso, nigro.—Neilgherries; *v. s. in herb. Champion.*

This is also a very distinct species: the leaves are much channelled at both extremities, and the midrib is very prominent towards the base, so that the continuous thick petiole stands at a considerable angle with the plane of the blade; they are smooth above, and below are thickly covered with dense yellowish tomentum; they are 6 inches long, and 2¾ broad, on a petiole 1 inch in length; the panicle is 4 inches long, its stem being 2 lines thick. The specimen in Capt. Champion's herbarium is very short, so that the lower leaves are probably much larger: the berry is nearly an inch in length and ¾ inch in diameter.

10. *Mappia montana.* Nothapodytes montana, *Bl. Mus. Bot. Lugd. Bat.* 248;—arbor ramosissima, ramis dichotomo-ramulosis, foliis sparsis, oblongis vel lanceolatis, utrinque angustatis, integerrimis, subcoriaceis, glabris, supra lucidis, subtus reticulato-venosis, petiolatis; paniculis corymbosis axillaribus vel infra gemmam terminalem ortis, cum alabastris pube sericea obductis; floribus parvis, brevissime pedicellatis, subcalyce articulatis, ebracteatis.—Java.

As the features offered by Prof. Blume in the work above cited,

of his genus *Nothapodytes,* quite correspond with those of *Mappia,* I feel no hesitation in considering these genera as identical; the characters of this species there given, being also analogous to the plants above described, and the proximity of the countries of their origin, all seem to confirm this conclusion.

Desmostachys.

I propose to establish this genus upon a plant of very peculiar habit from Madagascar, which I have found in the herbaria of Dr. Lindley and Sir William Hooker, remarkable for its several slender spicated racemes, growing out of each axil, whence its generic name, and which I adopt upon a manuscript suggestion of Dr. Planchon. It resembles *Mappia* in the structure of its flowers, but the floral parts are far more delicate and membranaceous in texture, and retain their yellowish colour in drying; the stamens and style are marked with numerous pellucid dots, and the anther-cells are thin and membranaceous; the ovarium is covered with very long setose hairs and is seated on a distinctly 5-lobed disk.

Desmostachys, gen. nov.—*Flores* perfecti. *Calyx* minimus, brevissime cupulatus, 5-dentatus, ciliatus, persistens. *Petala* 5, æqualia, hypogyna, lineari-oblonga, membranacea, extus pilosa, æstivatione valvata, apice inflexa, sub anthesi patentia. *Stamina* 5, longitudine petalorum et iis alterna; *filamenta* tenuiter linearia, membranacea, apice attenuata, disco inter lobos alternatim extus inserta; *antheræ* oblongæ, 2-lobæ, 4-locellatæ, imo breviter 2-fidæ, dorso medio affixæ, lobis membranaceis, singulatim 2-locellatis, demum septicidis et longitudinaliter evolutim dehiscentibus. *Ovarium* liberum, ovatum, villosum, *disco* cupuliformi obtuse 5-lobato suffultum, 1-loculare; *ovula* 2, juxta apicem loculi superposita, podospermio crasso subcollateraliter suspensa, anatropa. *Stylus* erectus, gracilis, glaber, pellucido-punctatus. *Stigma* obsolete lobatum. *Fructus* ignotus.—Frutex *scandens Madagascariensis*; folia *alterna, ovata, coriacea, glaberrima, petiolata*; racemi *plurimi, axillares, spicati, gracillimi, pauciflori, folio subbreviores,* floribus *minimis, sessilibus, bracteatis.*

1. *Desmostachys Planchonianus,* n. sp.;—scandens, ramulis teretibus, lævibus; foliis cuneato-ovatis vel lanceolato-oblongis, apice brevissime et repente attenuatis, crasso-coriaceis, utrinque lucidis et glaberrimis, supra læte viridibus, subtus pallidis, nervis venisque valde reticulatis prominentibus, margine revolutis, petiolo brevi, brunneo, rugoso, inflexo, canaliculato; racemis in axillis 5-8-fasciculatis, spicatis, gracillimis, pubes-

centibus, folio brevioribus, floribus minutis, alternatim sessilibus, petalis virescenti-flavidis.—Madagascar; *v. s. in herb. Lindley* (*Forbes*), *in herb. Hook.* (*Lyall*).

Among the several specimens I have seen of this plant, some have their leaves quite ovate, others nearly lanceolate, but as their shape varies in the same plant, they must all be considered as one species. It is described as climbing upon other trees, in the Province of Be-Zemcharak: the leaves are thin and coriaceous, shining, very reticulated, of a very light green colour above, from 2½ to 4 inches long, and from 1⅛ to 1½ inch broad, upon a thin incurved petiole, with a dark brown corrugated surface: from 4 to 8 slender spikes grow out of each of the upper axils, measuring 1 inch to 1½ inch in length; the flowers are alternately arranged, are quite sessile upon the slender pubescent peduncle, and are 1 line long, with a minute pubescent bract at the base of each*.

Poraqueiba.

No botanist has ventured to assign a position in the system to this very curious genus of Aublet until very lately, when M. Tulasne has given a description of it in the 11th vol. (3rd ser.) of the 'Ann. Sc. Nat.,' where he has very correctly referred it to Mr. Bentham's tribe of the *Icacineæ*. The analysis given in plate 47 of Aublet's work, though roughly drawn, is in the main correct, and the details there shown will be more easily comprehended from the particulars I am now able to offer. The singular partitions that stand in bold relief on the inner surface of the petals, are produced by their pressure, while in bud, upon the enclosed genitals; the force of this compression is such, that a portion of their fleshy substance is forced between the interstices of the curiously formed stamens, stamping a counter mould of their shape in the raised lines and deep cells that constitute the peculiar character of the petals; the upper and transverse portions of the very elevated cruciform partitions thus produced are deep, while the lower pale is broad and hollow in its centre, forming in this manner two very deep cells in the upper, and three parallel cells in the lower moiety. This however, as might naturally be expected, proves to be a variable character, for in a new species described by M. Tulasne, the two upper cells and the intervening deep keel are deficient, owing, it would appear, to the circumstance of the anthers being only half the length of those of the other species, so that the lower moiety only of each petal presents two cavities in which the stamens are lodged in the bud. The stamens are of very singular construction, and the figure in Aublet's drawing affords a very exaggerated idea of their form. In all the preceding genera, I have described the bilobed anthers as being always distinctly 4-celled before they burst, although after dehiscence, from the evolute mode of opening, they appear as if they had been only bilocular. In *Poraqueiba,* however, this 4-celled structure is rendered manifest in a much higher degree, for the cells are here perfectly distinct, and even separated from one another for a considerable distance by the intervention of a thick 4-sided pyramidal connective, composed of coarse reddish-coloured grains: this is covered by a whitish adhering cuticle, consisting of a thicker crustaceous epidermis, and a thinner and more membranaceous inner tegument; the narrow cylindrical pollen-cells, placed in the four salient angles of this connective, are formed by the continuation of the same cuticle, which here ceases to be adherent to the fleshy centre; the epidermis forms the anterior or external casing of the crustaceous cells, while the inner tegument constitutes the posterior lining of the cavity, which is at the same time free from the connective, although in contiguity with it, and which seems to form the receptacle for the attachment and assimilation of the pollen-grains: the pollen-cells, therefore, in reality appear to consist merely of a linear separation between the two membranes at the angles of the anther, and in all transverse sections of the same placed under the microscope, no sutural break in the continuity of the epidermis is discernible on either margin, where by its reduplication it becomes attached to the fleshy connective, nor is there any indication of a line of rupture or dehiscence. I confess therefore my inability to perceive, in any anther I have examined, the smallest appearance of bursting of the pollen-cells. M. Tulasne, on the contrary, states that they open longitudinally, by a fissure along the face of the connective; but whether sinistrorsely, or dextrorsely, or alternately so, he does not explain. In the summit of the anther, the same continuous crustaceous cuticle is extended, and drawn up into a short cylinder, or obtuse apical point, without any intervening connective, which apical point is again reflected downward along the upper portion of the anterior face of the anther, vanishing between the summits of the two anterior pollen-cells; the nature or function of this process is not apparent. In the structure of its pistillum, *Poraqueiba* resembles that of *Mappia.* Of its fruit nothing is recorded, more than that in its unripe state it is spherical, smooth, and mucronated. Although M. Tulasne has given a very elaborate description of this genus, it appears to me the following is a more correct expression of its character.

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* A drawing of this species with figures of its floral analysis, is given in plate 9.

PORAQUEIBA, Aubl.—*Flores* perfecti. *Calyx* imo brevissime cupulatus et carnosus, limbo 5-partitus, laciniis ovatis vel subacutis, ciliatis, æstivatione quincuncialiter imbricatis, persistens. *Petala* 5, æqualia, oblonga, carnosa, marginibus summo apiceque propendenti inflexis, intus carina profunda superne longitrorsim ex altera mediana transversali decurrente et in laminam latam concavam usque ad imum continuam cruciatim disposita, modo ut in locellos quinque sic divisa sunt, nempe, 2 superiora et 3 inferiora (vel carina suprema defectu solummodo in imo 3-locellata), locellis profundis glabris, carina suprema scabrido-papillosa, in compitum fasciculo pilorum donata, pilis rigidis albidis erecto-patentibus, æstivatione valvata, sub anthesi reflexa. *Stamina* 5, cum petalis disco hypogyno inserta, iisdem alterna, primum in locellos petalorum recondita, et circa pistillum arcte conniventia; *filamenta* carnosa, incurva, compressa, superne dilatata, apice subito attenuata; *antheræ* tetragonæ, conico-oblongæ, dorso gibbæ, basi truncatæ, et ibi versus dorsum apicifixæ, apice mucrone oblongo obtuso excentrico repente terminatæ, sub-2-lobæ, 4-loculares, loculis crustaceis, cylindricis, angustis, in angulos connectivi centralis valde crassi late discretis, 2 anticis brevioribus, propioribus, sursum attenuatis, 2 posticis summo attingentibus, incurvis, dehiscentia vix apparente (vel sec. cl. Tulasne rima longitudinali singulatim secus connectivi faciem apertis). *Ovarium* oblongum, pressione filamentorum sub-5-gonum, apice conicum, liberum, glabrum, disco parvo stipitatum, 1-loculare: *ovula* 2 juxta apicem loculi subcollateraliter superposita, podospermio carnoso suspensa. *Stylus* subbrevis, tereto-subulatus, crassiusculus, erectus. *Stigma* obsolete 3-lobum, subcavum. *Fructus* immaturus sphæricus, mucronulatus, glaber; *cætera* ignota.—Arbores *excelsæ Guianenses et Brasilienses, apice ramosæ*; folia *petiolata, alterna, ovata, acuta, integerrima, glabra*; inflorescentia *terminalis et axillaris, spicato-racemosa*, floribus *parvulis, albis, imo 2-bracteatis.*

1. *Poraqueiba Guianensis,* Aubl. Fl. Guian. i. 123. tab. 47. Barreria theobromæfolia, *Willd. Sp. Pl.* i. 1145; *Spr. Syst.* i. 583. Meisteria anonyma, *Scop. Gmel. Syst.* i. 391;—8-orgyalis, foliis oblongis, apice repente et breviter attenuatis, utrinque acutis, glaberrimis, coriaceis, reticulato-venosis, supra lucidis, subtus ferrugineo-brunneis, sub lente punctis albidis creberrimis et minutis notatis, rachi nervibusque prominulis et rufescentibus, margine undulato revolutis, petiolo brevi, canaliculato; racemo spicato axillari et terminali, floribus parvis, alternis, subglabris, albis, imo 2-bracteatis et cum pedicello brevissimo articulatis; petalis ovato-linearibus, intus

5-locellatis, staminibus æquilongis.—Guiana Gallica.—*v. s. in herb. Mus. Brit.* (*Aublet*).

This is described by Aublet as a fine tree 50 feet high with a copious branching summit: his original specimen, which exists in the British Museum, accords well with the drawing given in his work, only that the leaves being lower are somewhat larger; they answer however with his description, being 7½ inches long, 2½ to 3 inches broad, on a petiole of 3 lines.

2. *Poraqueiba Surinamensis*, n. sp. Poraqueiba Guianensis, *Tul. Ann. Sc. Nat.* (ser. 3) xi. 170;—foliis ovato-oblongis, apice longiuscule et repente attenuatis, glaberrimis, subtus ferrugineo-glaucis, sub lente punctis albidis creberrimis et minutis notatis, costa nervibusque prominentibus, rufescentibus, margine undulato revolutis, petiolo longiusculo, crasso, canaliculato; racemo spicato, axillari et terminali; floribus paucis, alternis, albis, imo 2-bracteatis, et cum pedicello brevissimo articulatis, petalis ovato-linearibus, extus adpresse pubescentibus, intus 5-locellatis, staminibus æquilongis.—Guiana Batava.—*v. s. in herb. Hook. et Mus. Brit.* Surinam (*Hostman*, no. 1209).

This species appears to me distinct from the former, the leaves being much broader with a thicker and much longer petiole, and a more lengthened and more branching panicle; its leaves measure 6¾ inches long, 3½ inches broad, on a fleshy petiole ¾ inch in length; the panicle is 3¼ inches long, composed of many divaricating branchlets*.

3. *Poraqueiba sericea*, Tulasne, *loc. cit.* p. 172;—excelsa, foliis latissime ellipticis vel ovato-ellipticis, basi rotundatis, vel abrupte breviterque in petiolum longum validum decurrentibus, apice mucronatis, supra glabris, subtus pilis minutissimis sericeo-pubentibus, nervis venisque prominulis; panicula racemosa, axillari, cinereo-pubescente, folio breviore, floribus approximatis, minoribus, imo bibracteolatis, et cum pedicello brevissimo articulatis, in alabastro ovato-globosis, petalis ovato-lanceolatis, imo 2-locellatis staminibus duplo longioribus, intus pilis brevibus patulis albo-lutescentibus vestita.—Brasilia æquatoriali, ad Egam Fluv. Nigri. (Pöpp. pl. no. 2597).

The leaves of this species are much larger and proportionally broader than the former, being from 6 to 10 inches long, 4 to 7 inches broad, on a petiole 1¼ to 1⅝ inch in length. The axillary panicle is from 4 to 6 inches long, and the flowers are barely 2 lines in length.

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* A representation of this species with analytical details is given in plate 10.

PENNANTIA.

The true affinity of this genus, established by Forster in 1773, has not hitherto been sufficiently well understood. Jussieu placed it among the genera of indeterminable position, hinting at the same time its probable relation with *Canarium,* a genus belonging to the *Terebinthaceæ.* Bartling considered it should be referred to the *Euphorbiaceæ.* Sprengel and Meissner held it to be an anomalous genus of the *Terebinthaceæ.* A. Richard (Voy. Astrol. 368) pronounced its station to be quite uncertain. Endlicher in his 'Prodromus' of Norfolk Island plants, placed it in *Rhamnaceæ,* a view confirmed by Lindley in his 'Introduction to Botany.' Endlicher again, in his 'Genera Plantarum,' arranged it among the doubtful genera of that family. Reisseck subsequently gave an elaborate description of its characters, when he endeavoured to show that it was closely related to *Mauria* and *Rhus* in *Anacardiaceæ,* in which opinion he was joined by Prof. Lindley in his 'Vegetable Kingdom,' and also by Endlicher in the 3rd Supplement of his 'Genera Plantarum.' Lastly, Dr. Planchon (Hook. Icon. 778) indicated its affinity with the *Olacaceæ.* The evidence I am now able to offer will prove satisfactorily that its true position is among the *Icacinaceæ,* although it offers certain peculiarities deserving our attention. It will be seen to accord with that family in all its most essential characters; viz. in its habit, its polygamous or diœcious flowers, its small persistent 5-toothed calyx, its 5 fleshy linear petals with an inflexed apical point and valvate æstivation; its 5 hypogynous stamens alternating with these and nearly equal to them in length, with filaments induplicated in the bud; its somewhat gibbous ovarium, entirely free, which by abortion is unilocular, with ovules suspended from near the summit of the cell; its drupaceous fruit, containing an osseous indehiscent putamen, which encloses a single suspended seed, and an embryo with superior radicle, enveloped in fleshy albumen. The peculiarities just alluded to consist in the retroverted position of its ovule, as shown in the development of the fruit, in a manner similar to that seen in *Euonymus,* and which probably will be found to exist in other genera of the *Icacinaceæ.* The summit of the putamen is furnished with a kind of dorsal and apical cristate protuberance, which is prominent in the typical species, but less so in the others, and which is also seen in the putamen of *Apodytes* and *Mappia*; but below the extremity of this crest in *Pennantia,* a very distinct foramen is evident, through which the strophiole or funicular support of the suspended seed passes, and which strophiole is evidently in connexion with the raphe-like cord that is seen imbedded in the pulp, proceeding from this point, along the external ventral side of the nut, to its base. A corresponding termination of the funiculus is observable in the putamen of *Mappia*; but there no such aperture exists, although the point of suspension is at the same spot, and a similar cord is likewise seen externally, descending from that point, along the ventral face to the base, as in *Pennantia*. Reisseck describes the ovarium as being sometimes 2-locular, though generally 1-locular, and in his analytical sections it is represented as having only a single cell. Endlicher, however, in his 'Prodr. Fl. Norf.' had long before stated it to be 3-locular, in the species from Norfolk Island, a fact repeated in his 'Genera Plantarum.' A. Cunningham, quoting the generic character upon Endlicher's authority, also describes the ovarium of the New Zealand species to be 3-locular (Ann. Nat. Hist. iii. 248). Endlicher, however, in the 3rd Supplement of the 'Genera Plantarum,' evidently upon the testimony of Reisseck, renounces his former statement, and describes the ovarium as being unilocular, a discrepancy manifestly attributable to different views, entertained at different times, in regard to its affinity, it having been referred at one period to *Rhamnaceæ*, at another to *Anacardiaceæ*: it is not recorded that such views originated in any careful observations upon its internal structure. Reisseck in addition states, that its ovarium (either 1- or 2-celled) has a single ovule suspended by a long filiform and erect placenta, which rises from the bottom of the cell to near the summit, as in *Rhus*; but I have not been able to observe any such feature, and the fact that the seed is suspended from a strophiole which passes through a foramen near the apex of the nut, and which is connected with the cord that descends hence externally to the calyx, militates strongly against the probability of the existence of any such internal connexion of the podosperm with the base of the cavity. In *Pennantia* we see the existence of a testa and integument furnished with a dorsal raphe and a nearly basal chalaza, which I have not been able to detect in *Mappia*; but in the latter case, these features were not distinguishable, on account of the seeds having been long desiccated, the albumen having become black, the integuments much decayed, and adhering to the cavity of the nut. The seed of *Pennantia* differs from that of *Mappia* in having a much smaller and almost terete embryo, placed in the upper portion of the albumen, in which respect it agrees with *Apodytes*, while in *Mappia* the cotyledons are of considerable size and foliaceous, as in *Celastrus*. It should also be remarked, that in the New Zealand and Norfolk Island species, the stigma is described as being large, pulviniform and sessile, exactly as it has erroneously been figured in *Stemonurus*; but, as in that genus, this will be seen to occur here alone in the ovuligerous flowers, and then only after the ovarium has attained a considerable increment and advance towards maturity. I have met with fertile female flowers only in the New Holland species, and there three very distinct and equal styles exist; the ovarium is deeply grooved into three corresponding lobes, each lobe being distinctly 1-celled, as I have found to occur in *Stemonurus*. Only one of the ovules in one of these cells becomes perfected, so that the fruit is only 1-celled and 1-seeded, but partial deviations from this rule sometimes occur. The ripe fruit of this same species is an oval drupe, surmounted by a sessile 3-lobed discoid plate, similar to that observed in the two other species of *Pennantia*, and in every species of *Stemonurus*, in *Sarcostigma* and in *Discophora*. As I have traced in *Pennantia Cunninghami* the existence of several distinct styles or stigmata, and the subsequent conversion of these organs into sessile discoid processes, we may safely infer that it is common to all the species of the several genera above mentioned; that after impregnation the styles become flattened and expanded, until they form a sessile fleshy disc, more or less lobed, upon the summit of the fruit: I feel convinced that Bauer, when he made his drawing of *P. Endlicheri*, sketched the figure of the ovarium after this transformation had taken place. The fact of the existence of three distinct styles and three separate cells in the ovarium, does not militate against the ordinary character of the *Icacinaceæ*, as demonstrated by the structure already shown to exist in the genera previously described; for though the ovarium is there uniformly 1-celled, I have all along endeavoured to prove that such is the case only by abortion, and that normally, in all those instances, it is in reality 3- or 5-celled. My object in constantly maintaining that fact, has been to show the fundamental difference in normal structure that exists between the *Icacinaceæ* and the *Olacaceæ*. In regard to the circumstance of the presence of three distinct styles in *Pennantia*, we must remember the very analogous structure in several genera of the section last described; for instance in *Apodytes*, *Rhaphiostylis* and *Leretia*; but in those cases, two of these styles are nearly obsolete, as are also two of the corresponding cells of the ovarium: in all these instances, the normal axis is in the centre of these cells, although two of them be only rudimentary; for where the ovarium is apparently only 1-celled, the ovules are invariably suspended near the apex of the cavity, upon the side of the abortive cells and of the two rudimentary styles. It is desirable to keep these facts in view when we come to speak of *Stemonurus* and *Sarcostigma*.

Among the numerous specimens in Sir Wm. Hooker's herbarium of *Pennantia corymbosa* from New Zealand, I have not been able to meet with a single ovarium that shows any trace of an ovule; this, in every flower I have examined, exhibits itself in the form of a terete, narrow, conical, or subulate style-like column, rising out of a pentangular hypogynous disc, and surmounted by a distinctly clavate and undivided stigma. On making sections both longitudinally and transversely, there appears nothing but a homogeneous fleshy mass: had I not encountered the necessary elements in the New Holland species, we should have had no evidence to guide us to the real structure. I have already described the pistillum, existing in that species, as appearing like three subulate processes, conjoined for two-thirds of their length, the upper parts free and erect, the united portions forming three distinct cells; one of these cells only appears ovuligerous, the ovulary body occupying the whole space of the cell and suspended by a short cord from the summit; but on account of the great tenuity of the walls of these cells, the soft texture of the ovule, and the minuteness of the parts, it is difficult to extract it entire; it bears at first sight the appearance of a single ovule, but from the overlapping of the visible edges, it would seem as if composed of two ovules pressed together: as I failed to separate them, owing to the reasons just mentioned, I cannot state with certainty that this body consists of two ovules. The analogy of this structure with what I have observed in *Stemonurus* and other genera will be found most complete, and it offers additional testimony to support what I have urged, in regard to the normal structure of the whole family.

I have alluded to the fact of the unusual occurrence of a raphe-like cord, imbedded in the pulp of the fruit, originating in the calyx, ascending along the external ventral side of the nut, and attaching itself to the strophiole of the seed which protrudes through the foramen just below the apex: this cord consists of two distinct threads, and apparently results from the extended remains of the two abortive cells, or it may consist merely of the nourishing fibres, become thickened, that constituted originally the axile column of the united carpels: its marked appearance in such a position is certainly an occurrence worthy of notice. I shall be able to show, that under certain circumstances, this external cord disappears, and the phænomena then observed all tend to confirm the inferences just drawn in regard to the true nature of this process.

Another fact remains to be mentioned that offers very instructive evidence. The two species of *Pennantia* from New Zealand and from Norfolk Island, both produce a drupe containing a solitary, hard, three-cornered nut, as has already been described: though very different in dimensions, their structure is precisely alike. The fruit of *P. Cunninghami*, on the contrary, encloses a thin, soft and coriaceous putamen, which is oval, 1-celled, and contains a single seed, resembling the two preceding species in structure and attachment; but the external cord is adherent, and cannot be detached from it without rupture. I have found, however, one instance in which the putamen is distinctly 2-celled, the cells being separated by a thin dissepiment, and each filled by a single seed, suspended in the usual manner from the summit of a thick internal cord, which originating in the base, proceeds close to the walls of the putamen, attached to one side of the dissepiment, reaches the summit of the cells, where it throws out two strophiolar processes, one into each cavity, from which the seeds are respectively suspended: it need hardly be suggested that the cord in question must be the elongated relic of the abortive third cell. This is an instructive fact, showing how necessary it is to trace the growth of seeds through all their successive stages from their origin, in order to understand their true structure and development. The circumstances observed in *Pennantia Cunninghami*, of possessing three distinct styles and cells in the fertile ovarium (a character which, for aught we know to the contrary, may be common to all the species), and of having also a drupe containing an oval coriaceous putamen, might induce some botanists to place this species in a genus distinct from the other hard-nutted species, but it appears to me that such differences are not sufficient to authorize their generic separation; should it be thought otherwise, it might bear the name of the section in which it is here placed. The following generic character is almost wholly based upon my own observations.

Pennantia, Forst.—Flores polygamo-dioici. *Calyx* parvus, crasso-discoideus, obsolete 5-dentatus, immutatus et persistens. *Petala* 5, oblonga, carnosula, glabra, æstivatione valvata, apice inflexa, sub anthesi patentia. *Stamina* 5, petalis alterna, iisdem longiora, ad marginem disci extus affixa; *filamenta* filiformia, æstivatione induplicata, in anthesi patentia: *antheræ* oblongæ, 2-lobæ, e basi ad medium 2-fidæ, lobis connectivo angustissimo et tenuissimo nexis, sejunctis, parallelis, subrugosis, apice basique interdum glandulis piliformibus donatis, singulatim 2-locellatis, valvulis e marginibus contiguis utrinque evolutis et hinc rima longitudinali late hiantibus: in floribus femineis polline destitutis. *Pollen* sub-4-gonum, rarius 3-gonum. *Ovarium* brevissimum, conicum, glabrum, disco pentagono suffultum; in floribus masculis teres, subulatum, carnosum, effœtum, stigmate capitato terminatum: in floribus femineis conicum, profunde 3-sulcatum, textura tenui, 3-loculare, loculis 2 (rarius 1) effœtis: *ovulum* unicum (vel potius gemellum ?) loculum implens, oblongum, funiculo sub-brevi ex apice suspensum. *Styli* 3, loculis ovarii continui, iis di-

midio breviores, erecti, subulati, *stigmata* totidem compressa, emarginato-spathulata, stylisque demum in discum sessilem epigynum fructus coronantem mutata. *Drupa* baccata, ovalis, monopyrena. *Putamen* osseum vel coriaceum, ovatum vel inæqualiter 3-gonum, apice ex angulo dorsali cristatum, summo faciei ventralis angustioris subcavum, et hinc foramine parvulo perforatum, 1-loculare, loculo callo 2-lobo infra foramen notato, monospermum. *Semen* medio strophiolæ suspensum, loculo conforme; *strophiola* crassa, foramen percurrens, et ad apicem chordæ conspicuæ per faciem externam putaminis ad torum continuæ adnexa: *testa* membranacea; *raphe* a strophiola apicali usque ad *chalazam* basalem latere dorsali producta. *Albumen* carnosum, dorso propter raphen immersum sulcatum: *embryo* isto dimidio brevior, apice inclusus, subteres, *cotyledonibus* ovatis, carnosulis, parvulis, *radicula* supera æquilongis.—Arbores *proceres* in Nova Hollandia et insulis Novæ Zeelandiæ Norfolkiæque *crescentes, glaberrimi*; folia *elliptica, coriacea, nitentia, integra, vel interdum grosse subdentata, petiolata*: corymbi *terminales, rarius axillares, multiflori*: flores *parvi, ad pedicellos bracteatos articulati.*

§ 1. Eupennantia. Putamen osseum, trigonum, sub apicem foramine conspicuo perforatum.

1. *Pennantia corymbosa,* Forst. Prodr. 396; A. Cunningham in Ann. Nat. Hist. iii. 248; Reisseck, Linnæa, xvi. 339. tab. 12; —arbor 6-orgyalis, ramis albo-punctatis; foliis cuneato-oblongis vel subellipticis, acutis, extra medium inæqualiter grosseque dentatis, interdum integris, emarginatis, coriaceis, glaberrimis, supra lucidis; panicula ampla, corymbosa, terminali, diffusa, puberula, multiflora, alabastris ellipsoideis; petalis patentibus, filamentis filiformibus, capillaceis, antheris oblongis; drupa atro-purpurea.—Nova Zeelandia.—*v. s. in herb. Hook.*

This species is so fully described and figured as above quoted, that it is not necessary to enter into any details. I may however remark that its leaves are much smaller, and far less coriaceous than the other two species, and being for the most part coarsely toothed, it bears a very different aspect. The upper leaves, as in the specimens in Sir Wm. Hooker's herbarium, scarcely exceed 1 or 1½ inch in length; but Reisseck states that the lower leaves are usually 2 or 3 inches long, as they are represented in his drawing. The nut is double the size of that of the next species*.

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* Analytical details only, of the floral and carpological structure observed in this species, will be appended to the drawing of *P. Endlicheri.*

2. *Pennantia Endlicheri,* Reisseck, Linnæa, xiii. 341. tab. 13. P. corymbosa, *Endl. Prodr. Fl. Norf.* 80; *Iconog.* tab. 121; *Ferd. Bauer, Ill. Pl. Norf.* tab. 165;—ramulis teretibus, fistulosis, cortice viridi, lenticellis pallide fuscis maculato; foliis elliptico-oblongis, aut obovatis, obtusis, retusisve, basi cuneatis, coriaceis, glaberrimis, supra nitentibus, subtus pallidioribus, nervis venisque prominulis, margine revolutis; panicula corymbosa, ampla, terminali, diffusa, multiflora, glabriuscula, floribus hermaphroditis cum pedicellis bracteatis pubescentibus articulatis, paucis masculis intermixtis, alabastris globoso-ovoideis glabris, petalis luteo-viridibus, subreflexis, filamentis subulato-filiformibus, antheris ovoideis: drupa minori, ovata, atro-purpurea, stigmate coronata.—In Insula Norfolkiæ.—*v. s. in herb. Hook.* (A. Cunn.).

It is worthy of notice that the delineations and analytical details of this species given in the 'Linnæa,' though marked on the plate as having been drawn by Reisseck, form a perfect facsimile of the plate in the 'Iconographia' above-quoted, which is a production of the pencil of Ferd. Bauer, and published four years previously; but in that of the 'Linnæa' several figures are added which do not exist in the other, giving sections of the ovarium, which are manifestly founded on error; for the ovule is there represented as being suspended at its apex from a long podosperm, springing from the base of the cell, as in *Rhus.* Much faith is to be placed on the drawings of Bauer, who has the reputation of having always correctly depicted what he saw, and it is therefore necessary to make a remark in regard to the figures in question, in which the ovarium is represented as bearing no style, but crowned with a pulvinate, 3-lobed, sessile stigma: this is so different from what I have observed in the young flowers of the species from New Holland, that I suspect the drawing was made from flowers advanced in age, where, by the growth of the ovarium, the styles had become obliterated, and the stigmata rendered sessile. Cunningham's specimens of the same plant are fructiferous only, and the berries are all crowned with a sessile stigma, so that I am unable to solve the doubt as to the fact in question, otherwise than from analogy, as shown in the preceding pages.

The lower leaves of this species are described by Endlicher as being 7½ inches long and 5 inches broad, but in the specimens in Sir Wm. Hooker's herbarium the upper leaves are 4½ inches long, 2½ inches broad, narrowed to the base into a somewhat slender petiole ¾ inch in length; they are shining, very thick and coriaceous: the corymb has its branches spreading broadly at nearly right angles, and is about 3 inches long. The fruit is an oval drupe, much smaller than the other two species, being only 4 lines long, and encloses a 3-gonous nut 3 lines in length*.

§ 2. Dermatocarpus. Putamen ovatum coriaceum.

3. *Pennantia Cunninghami*, n. sp.;—omnino glaberrima, ramulis teretibus, fistulosis, lenticellis pallidis verruculosis, foliis oblongis, utrinque acutis, apice acuminatis et mucronulatis, crasso-coriaceis, supra lucidis, nervis venisque immersis, subtus pallidioribus, nervis rubentibus prominulis, integris, margine subrevoluto undulatis, minutissime pellucido-punctulatis, petiolo canaliculato: paniculis corymbosis, terminalibus, et axillaribus, glabris, multifloris, folio dimidio brevioribus: alabastris ovoideo-oblongis, ♂ staminibus demum exsertis, filamentis brevioribus, induplicatis; antheris lineari-oblongis, rugosis, glanduloso-pilosulis; drupa olivæformi.—New South Wales, County of Camden.—(*v. s. in herb. Hook.—spec. in flor.* Illawarra, M'Arthur—*sp. in fruct.* Five Islands district, A. Cunningham.)

These specimens may be said to be from the same locality, for Illawarra, though on the mainland, is in the Five Islands district, and opposite to those islands in lat. S. 34° 50′, a little to the south of Port Jackson. From Cunningham's journal, he does not appear to have visited them, and all his specimens collected about Illawarra are stated as from "Five Islands." The leaves are larger than in the two foregoing species, are shining, smooth and coriaceous, 5½ inches long, 2½ inches broad, on a petiole ⅝ of an inch in length; those of the specimen from Illawarra are smaller, and evidently much younger; the panicle is 3½ inches long, with its branches less spreading †.

Stemonurus.

There can exist no doubt that the genus *Stemonurus*, proposed by Professor Blume in his 'Bijdragen' in 1826, is the same as the *Gomphandra* of Dr. Wallich, although they have hitherto been considered as distinct; but at the same time there is every reason to conclude, that both are again identical with the *Lasianthera* of Pal. de Beauvois, established as far antecedently as 1805, in his 'Flora Owariensis,' and placed by DeCandolle in his 'Prodromus' (i. p. 636) as a doubtful genus of the *Ampe-*

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* This plant, with carpological details, will be shown in plate 11 of this work.

† A representation of this species, with analytical details of its floral and carpological structure, will be given in plate 12.

lidæ: in such case, the latter name, on account of its priority, ought to claim the preference. As however it is contrary to the rules of science to form a compound generic term from both Greek and Latin roots, the name would necessarily require to be modified into *Lasiandra,* one that has long been preoccupied. Besides this, we have to consider the confusion likely to arise from increasing a list of consimilar names, already too numerous, as *Lasiandra, Lasianthæa, Lasiantha, Lasianthus,* and *Lasianthera,* and also, that in reality the latter name is untenable, because of the incorrectness of its signification, for in the present case it will be seen, that it is not the anther, but the filament which is villous. For all these reasons, I strongly recommend the preference to be given to *Stemonurus,* the next in priority, as the most appropriate designation of this genus.

Its most marked peculiarity consists in the character of its stamens; the filaments sometimes shorter, often longer than the petals, are generally very broad, extremely thick and fleshy, obtuse at their summit with a small apical point, to which the anthers are attached, and they have a somewhat prominent internal keel down the middle: the margins of their broad summit and the upper part of the keel are fringed with long transparent white hairs, clavate at their extremity and bent, so as to form a crest over the anthers: from this character both the names of Beauvois and Blume originated. The flowers, sometimes hermaphrodite, are frequently polygamous in the same plant, that is to say, either the anthers are void of pollen, or the ovarium is deficient of any ovules, or both these imperfections occur at the same time: it does not appear to me that they are constantly unisexual, as generally stated. The analysis of the structure of this genus has been attended with much difficulty, because of the frequent abortion of some of its parts, especially the ovarium, which is often deficient of cells or ovules; and even when the ovules exist, it is not easy to detect their presence, on account of their extreme minuteness, in an early stage of the flower. I was for a long while unable to solve the anomalies of its structure, and almost gave up the matter in despair, but patient examination at length overcame the difficulties: not one in twenty instances exhibits the smallest trace of an existing ovule, nothing but a fleshy mass appearing to constitute the ovarium, which is always comparatively small: indications of the existence of more cells than one are sometimes observable, but these are not large enough to be well defined; and even in the case where a single distinct cell exists with two suspended ovules, these are so minute that they might readily be overlooked. After the period of fecundation, however, the petals and stamens fall away, when the ovarium attains a rapid growth, and soon displays itself as an oblong cylindrical body of many times its former dimensions, seated on its small persistent calyx and crowned by a large pulvinate disk: it now unmistakeably exhibits to the naked eye a single cell containing two large suspended ovules and conforming to all the usual characters of the order. With one exception I have never met with flowers in an intermediate stage, and it is not therefore surprising that *Stemonurus* and *Gomphandra* should have been so long considered as two distinct genera. The nature of the pulviniform gland that forms so prominent a feature on the summit of the ovarium, and which evidently suggested the name given by Dr. Wallich, is not altogether manifest. On making a longitudinal section of a pistillum in its early stage, when it consists of a very small, 4- or 5-lobed, short cylinder, it will be seen crowned by a fleshy glandular ring of the same shape, but of a different colour from the lower and central portions, where the ovuligerous cell is seen, whenever discernible: this glandular appendage is sometimes in a small degree conical towards the centre, but more generally deeply umbilicate, and in the middle of this depression is seen a conspicuous prominence consisting of the real style and stigma: this is in the form of a very short hollow tube, crowned by four or five very minute teeth, corresponding in number to the lobes of the ovarium. On the growth of the pistil, in the manner before described, the gland just mentioned also expands, assuming the form of a large pulvinate disk, more or less lobed, which often exceeds in diameter, and therefore overhangs the summit of the ovarium, while the style and stigma become withered into a small central umbilicated depression. This early stage of the ovarium is tolerably well depicted in plate 953. fig. 5. of Dr. Wight's 'Icones,' while its subsequent clavated appearance is shown in plate 954. fig. 6. of the same work. I have frequently quoted instances of the existence of a similar epigynous gland upon the summit of an inferior ovarium, but I know of no instance in which it forms so prominent a mark as in this case.

At one time (*huj. op.* p. 54) it appeared to me desirable to unite the *Phlebocalymna* of Griffiths, as well as the *Platea* of Blume, with *Stemonurus*, which differ in no respect from the last-named genus, except in the absence of the villous fringe that forms such a remarkable crest overhanging the anthers: from Dr. Wight's 'Icones' I was at first led to believe that this was only a sexual difference, but careful observation does not confirm this conclusion. I find it a constant character in particular species, and on this account it will probably be better to keep *Stemonurus* distinct; but in this case *Phlebocalymna* and *Platea* will merge into another separate genus, the preference being given to the latter name on account of its priority: the differences which are observable between them will be discussed when we come to consider that genus. I propose to unite with them a species which I had placed in *Stemonurus*, under the name of *S. laxiflorus* (Cuming, no. 189, from the Philippine Islands), and also Dr. Wight's variety of *S. polymorpha*, figured in plate 953 of his 'Icones.'

The structure of the putamen bears much analogy to that of *Pennantia*: it is covered with a very small quantity of pulp, and is strongly ribbed by several longitudinal irregular lines: it is more coriaceous than osseous, and is of an oblong form, somewhat flatter upon the ventral face, on which side, a little below the summit, is seen a caruncular prominence, beneath which is a foramen communicating with the interior of the cell. On the same side near the base is another foramen; this however does not penetrate into the cell, but it pierces the substance of the shell obliquely by a hole which comes out in the point of its attachment to the calyx. Between these foramina is a deep groove filled with a thick chord of fibres: this chord, issuing from the interior of the nut, out of the upper perforation, descends through the basal passage just described, and terminates in the torus of the persistent calyx. By making a careful incision through each side of the shell, the cell is seen filled with an oblong seed, which is suspended from a thick funicular support, continuous with the raphe on one hand and with the chord before mentioned on the other: in *Pennantia* these parts are attached to one another, but here the bundle of fibres is continuous with the raphe, as well as with the external chord, that terminates in the basal torus. The raphe does not descend along the centre of the dorsal face of the seed, as in *Pennantia*, but takes a somewhat lateral course towards nearly the bottom, when it makes a sudden turn, and curving in a hippocrepical form ascends the opposite side of the same face, terminating in a caruncular prominence upon the apex of the seed. The thin integumental covering apparently consists of two adherent membranes, in which the raphe is imbedded; but there is no thickening of these membranes at the base, nor any appearance of a chalaza, unless the caruncular swelling at the apex can be so considered. The albumen is fleshy, and its embryo almost divides into two nearly equal portions, interposing a vacant space between them, and leaving on the edges only a very narrow solid rim of its albuminous substance to connect them; the embryo entirely lines this space, and consists of two extremely thin, almost pellicular cotyledons, which are oblong, nearly the size of the albumen, cordate at the summit, with a short terete radicle in its sinus. I have had an opportunity of examining only a single seed, and I can affirm with confidence that its structure was that above described. A result so greatly at variance with other recorded observations will naturally create a suspicion that the seed so examined may have been a malformation, but there appeared in this case no indication of any abnormal deformity: how then can we account for the existence of an embryo so different in size and form from that figured by Dr. Wight? Is it possible that this distinguished botanist, or more probably his draughtsman, can have mistaken the radicle for the entire embryo? This will appear probable when we carefully examine fig. 10 of his plate 954 above referred to, which gives a transverse section of the seed, where exactly the same lunated space is shown across the middle, which I found to exist, lined with the two thin membranes above described, and which I conceive can be nothing but cotyledons; and again, if we compare this with fig. 11 of the same plate, which is a longitudinal section of the same, we perceive a line or long space descending from the supposed embryo at the summit to the base of the albumen, a fact which precisely accords with what I have described in the preceding analysis. Upon such grounds I am inclined to believe, that what I have detailed above is the real structure of the seed in *Stemonurus*. In anatropal suspended seeds with a superior radicle, it is usual to observe the raphe terminate at the opposite extremity to the point of suspension; but in this case we find an exception to this general rule, which seems opposed to the established theory: here the direction of the raphe would seem to indicate a double retroversion of the ovule: so singular a fact may be of more frequent occurrence, but I confess that I have never met with, nor seen the record of, any such development. On the other hand, again, we have an analysis given by Blume of the seed of *Stemonurus secundiflorus* in his 'Mus. Lugd. Bat.,' in which the embryo is small in the summit of the albumen, as represented by Dr. Wight, the radicle being terete and the cotyledons exceedingly small.

The flowers of *Stemonurus* are sometimes 4-, often 5-merous, but I am not aware whether this can be depended on as a good specific character; all I can affirm is, that in those specimens I have seen, where 4-merous flowers prevail, I have occasionally met with some that are 5- or even 6-merous. Generally, the inflorescence is so short, as often to appear like a cluster of axillary fasciculated flowers; in other species it consists of long branching panicles, in which the flowers are sometimes secundly disposed. The flowers are always glabrous, and each articulated upon its separate pedicel, which is often pubescent. I have seen but few of the species on record, and those mostly imperfect specimens. In the following enumeration the characters are therefore given as described by their several authors; they require doubtlessly a more careful revision, for as they generally resemble each other so much in the appearance of the leaves, the shape of

which often varies in the same species, it is probable that better and more valid characters may be found in the inflorescence. The outline of generic features here offered is founded wholly on my own observation.

STEMONURUS, Bl. Lasianthera, *Pal. Beauv.* Gomphandra, *Wall.* —*Flores* hermaphroditi vel abortu polygami. *Calyx* parvus, brevissime cupularis, limbo fere integro, 4–5-denticulato, vel 4–5-fido, immutatus et persistens. *Petala* 4–5, hypogyna, oblonga, carnosa, summo marginibus mucroneque apicali propendenti inflexis, æstivatione valvata, libera, vel interdum marginibus imo cohærentibus, simulque cum filamentis adhæsis in tubum cylindraceum sic leviter agglutinatis, e medio liberis et reflexis. *Stamina* 4–5, cum petalis inserta, iisdem alterna; *filamenta* sæpe aucta et demum exserta, crasso-carnosa, lata, compressa, incurvula, summo truncato ac breviter repente acuto, carinaque interna mediana, pilis longis albidis apice clavatis munita; *antheræ* istis æquilatæ, ovatæ, introrsæ, plus minusve cordatæ, 2-lobæ, lobis singulatim 2-locellatis demum septicidis et longitudinaliter evolutim dehiscentibus. *Pollen* acute 3-gonum. *Ovarium* globoso-conicum, 4–5-sulcatum, disco parvo insitum, glandula crassa sub-annulari aut sublobata coronatum, sæpissime sterili, quandoque fertili et tunc cito multoties elongatum et cylindricum, 1-loculare, *ovula* 2 anatropa juxta apicem loculi subcollateraliter superposita, podospermio crasso suspensa. *Stylus* brevissimus, conicus, 4–5-sulcatus, summo cavus, dentibusque 4–5 erectis stigmatosis terminatus, et simul cum glandula (in ovario fertili) in discum magnum pulvinatum sub-lobatum epigynum demum auctus. *Drupa* oblonga, parcissime carnosa, olivæformis, interdum elongata, monopyrena, calyce persistente suffulta, et pulvino coronata: *putamen* lignosum, ovato-oblongum, dorso convexius, uniloculare, monospermum, ad faciem ventralem planiusculam infra apicem foramine parvo (loculo attingente) perforatum, hinc extus fere ad imum longitudinaliter profunde canaliculatum, illinc usque ad fundum introitu diagonali (loculo evitante) pertusum. *Semen* conforme, funiculo infra apicem loculi suspensum; *funiculus* crassus, fibrosus, e rapheo dorsali ortus, per foramen apicale loculi trajectus, tunc canalem externum pervadens, et introitum basalem penetrans, denique in toro amissus; *testa* submembranacea, cum integumento interno cohærens; *raphe* hippocrepicus in faciem dorsalem testæ immersus, primum ex apice versus latus fere ad imum decurrens, hinc repente deflexus, per latus adversum fere ad apicem accurrens, et in carunculam apicalem desitus. *Embryo* inversus, rectus, *cotyledonibus* magnis, cordatis, textura tenuissimis, latitudine curvatis, in medio albuminis carnosi fere æquanti immersis, *radicula* brevi, tereti, supera, 6-plo longioribus. [Ex iconibus et descriptionbus clar. Wight et Blume *embryo* in apicem albuminis immersus, brevis, *radicula* tereti, supera, *cotyledonibus* minutissimis, compressis.]—Arbores vel frutices *Indiæ Orientalis et Archipelagi Asiatici indigenæ*: folia *alterna, elliptica, vel lanceolata, coriacea, glaberrima, petiolata*; flores *parvi, flavo-viriduli, odoratissimi, in racemos spicatos sæpe 1-laterales, vel in cymas axillares rarius oppositifolias dispositi, interdum* (*præsertim in ovuligeris*) *fasciculato-aggregati*; fructus *purpureus*.

1. *Stemonurus pauciflorus*, Bl. Bijd. 648;—foliis oblongis, acuminatis, basi acutis, glabris; pedunculis brevibus apice 2–3-fidis, 2–3-floris.—Java.

2. *Stemonurus secundiflorus*, Bl. Bijd. 649;—arbor 10-pedalis; foliis oblongis, acutis, basi angustatis, coriaceis, glabris, aveniis, apice spicis 3–4-fidis, floribus secundis, filamentis carnosis, linearibus, petalis æquilongis, pilis longissimis clavatis ciliatis; drupa valde elongata, apice attenuata.—Java.

3. *Stemonurus Javanicus*, Bl. *l. c.*;—foliis oblongis, utrinque acuminatis, coriaceis, glabris, venosis; cymis solitariis geminisve densifloris.—Insul. Nusa Kambanga.

   β. foliis ovalibus, utrinque acuminatis, submembranaceis, glabris, junioribus ad costam infra puberulis; cymis dichotomis solitariis.

4. *Stemonurus quadrifidus*, Bl. Mus. Bot. Lugd. Bat. 249;—foliis e basi acutiusculis, oblongis v. oblongo-lanceolatis, obtuse acuminatis, membranaceis, cymis umbellato-4-fidis, multifloris.—Sumatra.—Folia 3¼ ad 6 poll. longa, 1–1¾ poll. lata.

5. *Stemonurus prasinus*, Bl. *l. c.* S. Javanicus, *Krthls.*;—foliis e basi acutiuscula ellipticis, v. elliptico-oblongis, longiuscule acuminatis, membranaceis; cymis 3-furcatis, multifloris.—Sumatra.—Folia 4½–6 poll. longa, 1¾–3 poll. lata.

6. *Stemonurus macrocarpus*, Bl. *l. c.*;—foliis e basi acutiuscula ellipticis, v. elliptico-oblongis, obtuse acuminatis, subcoriaceis; pedunculis solitariis paucifloris, fructibus elongato-ellipsoideis.—Ins. Borneo.—Folia 4½–6 poll. longa, 2¼–3 poll. lata (evidenter ♀).

7. *Stemonurus macrophyllus*, Bl. *l. c.*;—foliis e basi acuta ellipticis, obtuse acuminatis, coriaceis; racemis geminis confertisve; fructibus cylindraceis.—In Archip. Indico.—Folia 5½–9 poll. longa, 2¾–4½ poll. lata.

8. *Stemonurus parviflorus*, Bl. *l. c.*;—foliis e basi acuta vel obtusa oblongis vel elliptico-oblongis, acuminatis, membranaceis, cymis brevissimis densifloris, drupis cylindricis.—Sumatra.—Folia 5–10 poll. longa, 2–4 poll. lata.

9. *Stemonurus? littoralis*, Bl. *l. c.*;—foliis e basi acutiuscula v. obtusa ellipticis, acuminatis, coriaceis.—Nova Guinea.—Folia 6–9 poll. longa, 3½–4 poll. lata.

10. *Stemonurus? membranaceus*, Bl. *l. c.*;—foliis e basi acuta elliptico-oblongis vel oblongo-lanceolatis, acuminatis, membranaceis.—Java.—Folia 6–10 poll. longa, 2½–3¼ poll. lata.

11. *Stemonurus Africanus*. Lasianthera Africana, *Pal. Beauv. Fl. Owar.* i. 85, tab. 51; *D.C. Prodr.* i. 636;—suffrutex scandens, foliis lanceolato- vel ovato-oblongis, cuspidatis, imo rotundatis, apice longe acuminatis vel cuspidatis, cyma oppositifolia, apice umbellatim ramosa, ovarii stylo brevi, stigmate obtuso.—Africa tropica; Chama, fl. St. Jago.—Folia 6 poll. longa, 2 poll. lata, petiolus 1-pollicaris: inflorescentia 2-pollicaris, ramis 4–5-umbellatis, floribus apice agglomeratis.

12. *Stemonurus coriaceus*. Gomphandra coriacea, *Wight, Ill. Ind. Bot.* i. 103;—dioicus, foliis coriaceis, ovalibus, utrinque attenuatis vel obovato-cuneatis, floribus 4-andris, cymis ♂ axillaribus, 4 floris; ♀ floribus solitariis vel 2–3, racemosis, fructibus oblongis, cylindraceis.—Ind. Oriental.

13. *Stemonurus polymorphus*. Gomphandra polymorpha, *Wight, Ill. Ind. Bot.* i. 103; *Icon. Pl.* tab. 953–954;—glaber, foliis oblongis vel obovato-lanceolatis, acuminatis, membranaceis, subtus glaucis, breviter petiolatis; cymis axillaribus solitariis vel geminis petiolum æquantibus, masculis plurifloris, fœmineis 2–5-floris, calyce integro minute 4–5-dentatis, petalis 4–5, glabris, staminibus exsertis, cristato-pilosis, fructibus ovoideis.—India orientalis.

Var. *α. acuminata, β. oblongifolia, γ. angustifolia, δ. longifolia, ε. ovalifolia.*

This species is described as being commonly diffused over the whole Peninsula of India, and subject to many varieties of form, but I suspect that if these were more carefully examined, several specific differences would be found to exist among them. I have copied the character from Dr. Wight's description, omitting however three features, viz. "dioicus"—"petalis basi in corollam tubulosam coalitis"—and "antheris minute cristato-pilosis." I find in all cases the petals are quite free, although strongly

agglutinated by their edges, and that they do not open even at the summits until some time after impregnation, and then they gradually become separated at their edges to the base, after which, in time, they fall off. There seems to have been a general conviction among botanists, that in *Gomphandra* the anthers are pilose; this is so stated by Endlicher and Wight, but in every instance I have found the clavate hairs that form a hooded crest over the anthers all spring from the filaments. Dr. Wight, in his 'Icones,' represents the male plant in this species as having beardless stamens (see figs. 1 & 4. tab. 953), and it is worthy of note that the ovarium is here depicted as being ovuligerous (see fig. 6): the female plant in plate 954 has bearded stamens with a fertile ovarium, the progress of the development of which, to the state of ripened fruit, is here shown: it has hence been inferred by that distinguished botanist, that the occurrence of bearded or beardless stamens constitutes a true sexual distinction. My observation upon dried specimens leads me to an opposite conclusion, for I find in every instance I have examined, that the stamens are bearded even in the male flowers, that is to say, where the ovarium has been quite sterile: and even in what are called female flowers, that is, where the ovarium is ovuligerous, the stamens are equally barbed, whether the anthers be charged with pollen or filled only with a grumous mass. I am therefore led to the irresistible conclusion, that the plant figured by Dr. Wight as the male plant of *Gomphandra polymorpha* belongs to a distinct genus, being a species of Blume's *Platea*, which will be hereafter described. As additional evidence in favour of this conclusion, I may mention the fact, that Dr. Wight describes the male plant in plate 953 as flowering in the months of March and April, and the female plant in plate 954 as having its fruit ripened in the same months: this would occur probably alone on the supposition that the fruit was the production of a previous year's growth.

Among the Ceylon collection of the late Mr. Gardner (no. 102) is a plant which I take to be the variety *longifolius* of this species: it is certainly different from the *longifolius* of Dr. Wallich's collection, which will be presently described; the leaves are here of a light pallid green; two or three short dichotomous racemes grow out of each axil; the calyx is entire, but the petals and stamens have all fallen away; the ovarium is long and cylindrical, and is terminated by a flattened 5-lobed disk, which considerably exceeds in diameter that of the ovarium; it is 1-celled, with two large ovules suspended from near the summit of the cavity: on account of the clavate form of the ovarium this affords a good illustration of Dr. Wallich's genus *Gomphandra*, and is well represented in Wight's 'Icones,' tab. 954. figs. 6 & 7. The remarks offered upon the development of the ovarium in *S. affinis* will equally apply to the present instance*.

14. *Stemonurus Gardneri,* n. sp.;—glaber, ramulis teretibus, subflexuosis; foliis ellipticis, utrinque acutis, apice obtusiusculo breviter lineari-angustatis, glaberrimis, valde coriaceis, utrinque eveniis, costa nervisque supra impresso-sulcatis, subtus prominentibus, inferne subferrugineis margine revoluto, petiolo longiusculo, tereti, superne haud sulcato; racemo oppositifolio, petiolo longiori, floribus masculis paniculatis 5-meris, staminibus in alabastro petalis brevioribus, pilis clavatis antheris brevioribus munitis; fructu oblongo, disco 10-lobo umbilicato coronato.—In Mont. Neilgherrensib.

The plant here described was sent to me by the late Mr. Gardner as the *Gomphandra polymorpha,* being collected by him as such, in company with Dr. Wight, in the Neilgherry Hills: it might therefore be considered as an authentic sample of this species. Its characters however will be seen to be quite at variance with those given by Dr. Wight of other plants of this species, collected by him in the same neighbourhood, where the leaves are said to be membranaceous and shortly petioled: here, on the contrary, they are extremely opaque and thickly coriaceous: the inflorescence is not only there described, but figured as being axillary; here, on the contrary, it is always opposite to the leaves. It is not easy to say whether this plant is referrible to any of the varieties mentioned by Dr. Wight, but from the differences here shown, it certainly claims the rank of a species distinct from his *Gomphandra polymorpha*. The leaves are $2\frac{3}{4}$–$3\frac{1}{4}$ inches long, $1\frac{1}{4}$–$1\frac{1}{2}$ inch broad, on a petiole half an inch in length; the male panicle is branching, nearly an inch in length, with flowers oval in bud, about $1\frac{1}{2}$ line long; both the male and female inflorescence, as in the following species, spring from the side of the stem opposite to the petiole: the calyx is cupshaped, with a 5-denticulated margin; the five petals are oblong, with inflexed margins and apex; the stamens, shorter than these, have fleshy filaments, with glandular hairs scarcely longer than the anthers: the ovarium is oblong, glabrous, sterile, with a conical hollow style. The fructiferous raceme is $\frac{3}{4}$ of an inch long, bearing an oblong drupe, 7 lines in length, surmounted by a depressed, umbilicated, 10-lobed disk, and supported upon its minute, persistent calyx. The internal structure of the fruit has been already described in page 83.

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* The analysis of the structure of the flowers and of the seed of this species will be shown in plate 13.

15. *Stemonurus Penangianus.* Gomphandra Penangiana, *Wall.*;—ramulis teretibus, pallide ferrugineis; foliis oblongo-lanceolatis, imo cuneatis, apice lineari-angustatis, coriaceis, glaberrimis, subtus pallidioribus margine revoluto, petiolo brevi, crassiusculo, profunde canaliculato; cyma oppositifolia, sub-umbellatim et 2–3–4-chotome ramosa, floribus hermaphroditis, secundis, cum pedicellis articulatis, valde deciduis, carina interna petalorum in appendice longe propendenti inflexa maxime producta, filamentis longe ciliatis, antheris polliniferis, ovario brevissimo, 5-gono, apice pulviniformi et umbilicato, stylo conico, sub-brevi, tubuloso, dentibus 5 erectis acutis terminato.—Penang.—(*v. s. in herb. Soc. Linn. Wall. Cat.* 7204.)

This species is very distinct on account of its singularly branching racemes, with long rows of secund flowers, which are always placed on the side of the stem opposite to the insertion of the petiole. The stems are quite glabrous and of a dull light brown colour. The leaves are about 5½ inches long, 1½–1¾ inch broad, on a petiole 3 or 4 lines in length. The primary peduncle is 3 to 6 lines long, branching somewhat umbellately into from three to six branches, which are again dichotomously, or sometimes umbellately subdivided into lengthened curving branchlets, from 6 to 9 lines long, closely and pectinately beset with pedicels, from which the articulated flowers have fallen off, all being quite glabrous and of an ochreous colour. The calyx is small, cupshaped, minutely 5-toothed; the petals adhere by their margins below in a tubular form, the summits being quite free; the stamens are the length of the petals, but the long ciliated crests are far exserted; the filaments are thick and fleshy, having their margins and apices charged with very long clavate white hairs; the upper part of the inner keel interposes between the lower part of the two lobes of the anthers, which are oval, deeply separated at their base, the lobes being attached dorsally at their junction to the apical point of the filament; they are polliniferous, the granules of pollen being sharply 3-angular: the ovarium is distinctly ovuligerous.

16. *Stemonurus longifolius.* Olax longifolia, *Wall.*;—ramulis teretibus, gracilibus, glabris, ochraceis; foliis valde lanceolatis, utrinque acutis, apice lineari-angustatis, glaberrimis, flavovirentibus, subtus pallidioribus, petiolo gracili; panicula pauciflora, glaberrima, petiolo vix longiori, floribus glabris, petalis 4, staminibus 4, filamentis crassis, dilatatis, longe ciliolatis, antheris effœtis, ovario sterili, 4-sulcato, stylo conico tubuloso 4–5-dentato coronato.—Sylhet.—(*v. s. in herb. Soc. Linn. Wall. Cat.* 6782 *A. et B.*)

This species is remarkable for its very long narrow leaves, which are attenuated at their apex into a lengthened linear extension; they are of a pale colour above, of a glaucous yellowish hue below, about 6 inches long, including the linear apical extension of an inch in length, and $\frac{7}{8}$ of an inch broad, upon a slender petiole 3 or 4 lines in length. The inflorescence seldom exceeds 4 lines in length, several flowers about 2 lines long being almost fasciculated on an axillary peduncle of 2 lines in length, all quite glabrous: the calyx is small, cupshaped and 5-toothed; petals 4, linear; stamens 4, with very fleshy filaments nearly the length of the petals, furnished on their margins and apex with a dense fringe of long clubshaped hairs; the two anther lobes are each 2-celled, sterile, and filled with grumous matter; the ovarium is smooth, cylindrical, $\frac{1}{4}$ or $\frac{1}{6}$ the length of the stamens, sterile, and terminated by a hollow, tubular, conical style, divided at its apex into four acute erect teeth.

17. *Stemonurus Heyneanus.* Olax Heyneanus, *Wall.*;—ramulis subflexuosis, glabris; foliis oblongis, utrinque acutis, apice breviter repente angustatis, glaberrimis, opacis, petiolo gracili; racemo axillari, petiolo sublongiori, bifido, vel subdichotome ramoso, floribus secundis, vel subaggregatis; calyce cupuliformi, 5-denticulato, petalis 4–5, linearibus, apicula inflexa longe propendenti, staminibus 4–5, crassis, demum elongatis et exsertis, pilis clavatis antheris fertilibus 2-plo longioribus munitis; ovario sterili, subgloboso, 4–5-sulcato, apice pulviniformi, subumbilicato, stylo brevissimo, fere obsoleto.—India. Orient.—(*v. s. in herb. Soc. Linn. et Hook., Wall. Cat.* 6780.—Ceylon, *Gardner*, 102.)

This plant bears much the aspect of *Stemonurus polymorphus*; the leaves are of a pale green, of nearly the same hue on both sides; the specimens in the herbarium of the Linnæan Society are oblong, with parallel sides, or sometimes tapering a little towards the base from the upper part, where they are broadest, and then suddenly contracted into a narrow and obtuse point; they are 3 to 3½ inches long, 1½ inch broad, on a slender petiole about 4 lines in length. In the Ceylon specimens the leaves taper more regularly to each extremity, and are somewhat narrower. The flowers are generally 5-, rarely 4-merous; sometimes the hairs of the stamens are short and nearly obsolete, at other times double the length of the anthers; the cells of these are in some specimens replete with perfect pollen, in others filled with grumous matter: the ovarium is generally depressed or globose, and I have never met with a single instance of their possessing ovuligerous cells.

18. *Stemonurus axillaris.* Gomphandra axillaris, *Wall.* Lasi-

anthera tetrandra, *Wall. Flor. Ind. Or.* vol. ii.;—ramulis teretibus, flexuosis, substriatis, glabris; foliis oblongis, utrinque acuminatis, apice angustato-attenuatis, glabris, opacis, subtus pallidioribus, margine revoluto; panicula ramosa, petiolo paullo longiori, glabra, floribus crebris, subsecundis, 4–5-meris, calyce cupuliformi, 5-denticulato, petalis margine inflexis, apice longe propendenti, staminibus fertilibus, longissime ciliolatis, ovario sæpe sterili, interdum ovuligero, oblongo, vel subgloboso, 4–5-gono, stylo conico, tubuloso, apice 4–5-dentato.—Sylhet. —*v. s. in herb. Soc. Linn. Wall. Cat.* 3718.)

As in *S. Penangianus,* I have observed that in many cases where the ovarium is ovuligerous, the anthers have been charged with perfect pollen, so that such flowers may be said to be truly hermaphrodite: in most instances, however, the ovarium is sterile. The leaves are from 3½ to 4½ inches long, including a narrow and almost linear apical point of half an inch in length; they are 1¼ to 1½ inch broad, on a petiole half an inch long: the racemes, ⅝ to ¾ inch long, have numerous crowded flowers which do not exceed 3 lines in length: the hairs of the filaments are three or four times the length of the anthers, and arch over them in a very graceful manner: the pollen-grains are acutely 3-gonous.

19. *Stemonurus Cumingianus,* n. sp.;—ramulis flexuosis, teretibus, ferrugineo vel flavido-tomentosis; foliis oblongis, utrinque acutis, apice repente attenuatis, supra glabris, subtus brunneis et sparse pubescentibus, costa nervis petioloque ferrugineo-pilosulis, margine subrevoluto; panicula ramosa, petiolo tenui vix longiore, pubescente, floribus ♂ crebris, subcapitatis, 5-meris; calyce brevissimo, 5-denticulato, piloso, petalis glabris, oblongis, summo marginibus apiculaque longa propendenti inflexis; staminibus iisdem brevioribus, latis, crassis, pilis clavatis longissimis ciliolatis; ovario oblongo, piloso, dentibus 5 coronato.—Insul. Philip.—*v. s. in herb. Hook. et Lindl.* (Cuming, 796).

The leaves here are 5–6½ inches long, and 2½–3 inches broad, on a petiole 5–7 lines in length; the panicle is trichotomously branched, with crowded 5-merous flowers, which are still in bud; the upper margins of the petals are deeply inflected, together with their long apical points, which are all closely agglutinated into a long process that hangs down in the centre of the anthers; the filaments are rather short and broad, fringed with extremely long glandular hairs; the ovarium, seated on a short glabrous disc, is cylindrical, and altogether very pilose, growing smaller and more conical towards the summit, where it is hollow and 5-toothed.

20. *Stemonurus Ceylanicus*, n. sp.;—ramulis glabris, ochraceis; foliis oblongis, utrinque virentibus, subtus pallidis, costa mediana prominenti; paniculis axillaribus, geminis, dichotome ramosis, petiolo brevi 3-plo longioribus, pubescentibus, floribus in ramis secundis, crebris, calyce 5-denticulato, glabro, petalis linearibus, sicco aurantiacis, staminibus iisdem æquilongis, apice carinaque interna longissime ciliolatis; ovario sterili, glabro, depresso–10-lobato, apice profunde umbilicato, stylo brevissimo in cavitatem incluso.—Ceylon.—*v. s. in herb. Lindl. et Hook.* (Macrae, 428).

This species differs from *S. Penangianus* in the axillary origin of its inflorescence, in its much shorter and geminate panicles, in which the flowers, though somewhat secund, appear almost aggregated. The leaves, which are thin and almost membranaceous in texture, appear when dried of a darkish green above, and of a very pale green beneath, with prominent nervures and veins; they are about 6 inches long, and nearly 2 inches broad, on a petiole barely exceeding 3 lines in length. The panicles are scarcely 9 lines long; the calyx is small, obsoletely 5-toothed; the five petals are linear, with a long inflected apex; the five stamens are equal to them in length, with broad, thick, fleshy filaments, the internal keel, upper margins and summit being closely fringed with very long clavated hairs, which are three times the length of the anthers; these consist of two oval lobes, fixed together by a point near the apex, where they are attached to the filaments, the lobes below being separated by the summit of the keel, so that they rest in two cavities in the apex of the filaments, as occurs in most species of this genus; the ovarium is globular, somewhat 10-lobed, depressed at the summit, and deeply umbilicated in the centre, in the cavity of which, the obsolete style and stigma, forming a depressed lobe, lie concealed; the body of the ovarium is fleshy, with no apparent cells*.

21. *Stemonurus Walkeri*, n. sp.;—ramulis teretibus, subdichotome divisis; foliis oblongis, imo vix acutis, apice valde obtuso et hinc subito attenuatis, utrinque glaberrimis fuscis et concoloribus, crasso-coriaceis, supra nitido-opacis, costa sulcatis, nervis immersis, subtus costa crassiuscula nervisque tenuissimis prominentibus, margine subrevoluto, petiolo breviusculo; racemo axillari, brevi, paucifloro, floribus ♂ 4-meris, ♀ 5-meris, filamentis crassis, apice sub-breviter ciliolatis.—Ceylon.—*v. s. in herb. Hook.* (♂ *Col. Walker*, ♀ *Gardner*, 101).

This species is distinguishable by its much darker and more fleshy, smooth leaves, which are nearly 4 inches long, and 1½ inch broad, on a rather stout petiole, about 4 lines in length; the calyx is small, and rather deeply 5-toothed; the male flowers have oblong petals, with an internal longitudinal keel, and a long inflexed apical joint, four stamens equal to them in length, with very broad, thick, fleshy filaments, which are furnished on the upper margin with a row of clavate hairs, scarcely longer than the anthers; the pollen is acutely 3-angular; the ovarium is sterile, oblong, with a rather long, conical, hollow style, toothed at its apex. The female flowers have five thick fleshy petals, and five stamens formed like the others, but the cells are filled with grumous matter; the ovarium is nearly the length of the stamens, somewhat 5-grooved, globular in its lower moiety, smaller and cylindrical in its upper half, which presents here somewhat excentrically, a single cell with two distinct ovules suspended from near the summit, on the side towards the axis: the apex of the very short ovarium is crowned with a conical, 5-lobed, disciform process, equal to it in diameter, the summit being terminated by five very minute teeth*.

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* A representation of this species, with the details of its floral structure, will be given in plate 13.

22. *Stemonurus affinis*, n. sp.;—ramulis tortuosis, nodosis; foliis ellipticis, utrinque subacuminatis, apice obtusiusculo attenuatis, opacis, supra in costam sulcatis, subtus pallidioribus, costa nervis venisque prominulis, margine subrevoluto, petiolo tenui teretiusculo superne sulcato; panicula axillari, pauciflora, petiolo vix longiore, pedicellis pubescentibus, calyce 5-dentato petalisque oblongis breviter apiculatis glabris, staminibus iisdem vix æquilongis, filamentorum apicibus carinaque interna longissime ciliatis, ovario fertili, longitudine staminum, longe cylindrico, paullulo incurvo, apice pulvinato.—Malacca.—*v. s. in herb. Hook.* (Griffiths).

This species is near *S. polymorpha*, but differs in several particulars. It appears to be a remarkably knotty and scrubby tree; its leaves are about 3½ inches long, 1¼ to 1⅜ inch broad, on a petiole 4 or 5 lines in length; its panicles are 6 or 8 lines long, and its flowers offer a very instructive exemplification of the development of the ovarium; the last-mentioned species exhibiting an intermediate stage, between that described in *S. Penangianus*, and this, which offers another manifest instance of Dr. Wallich's genus *Gomphandra*. Here the fleshy petals are linearly oblong, with a comparatively short inflexed apex; the stamens are not equal to them in length; the filaments exceed the anthers in breadth, but are not quite so thick as in other species; they are suddenly contracted to a sharp point at the apex, and have a less prominent internal keel, the summit of which, together with the upper margins of the filaments, are fringed with very long clavate hairs; the anthers are 2-lobed and sagittate from near the almost apical point of their attachment; the lobes are membranaceous, each longitudinally split open and quite void of pollen or other matter, so that it is not apparent whether they have been fertile or sterile. The ovarium is the length of the stamens, is cylindrical, a little curved, and rather thicker towards the apex; in diameter it is scarcely broader than the filaments, quite smooth, and surmounted by a short, compressed, umbilicated, and somewhat 5-lobed disciform process, which partly overhangs the summit; the body of the ovarium exhibits only a single large cell, of nearly its whole length, from one side of which, near the summit, two ovules, that almost fill the cavity of the cell, are suspended, each from a short cupshaped strophiole*.

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* A figure of this species, and an analysis of its floral structure, will be shown in plate 14.

PLATEA.

In commenting upon the genera of the *Icacinaceæ,* I have frequently spoken of *Phlebocalymna,* a manuscript name proposed by Mr. Griffiths for a plant collected by him in the Malacca Peninsula, but as I am unable to discover that any of its characters are appreciably distinct from the *Platea* of Blume, the former must necessarily merge into the latter genus, which was first established by that distinguished botanist in his 'Bijdragen,' and more lately recorded in his 'Mus. Bot. Lugd.,' where he enumerates another new species. In describing the characters of *Stemonurus,* I have stated (*ante,* p. 82), that the chief or perhaps only feature that can distinguish *Platea,* is the absence of the glandular hairs, that form a beautifully fringed crest over the anthers in the former genus, and as this was believed only to be a sexual difference, I had considered *Platea* as identical with *Stemonurus.* In the former, as also occurs in many species of the latter genus, the filaments are said by Blume to be short and broad (whence probably the generic name from *πλατεῖα, amplus*), while in *Phlebocalymna,* although when in bud they are short and broad at base, they become afterwards long and linear: the differences in regard to their relative length and breadth are probably only specific, as we find them to occur in *Stemonurus.* After desiccation, the flowers of *Phlebocalymna* appear of an orange colour, which is probably retained from the living state; they are somewhat more transparent and agglutinated at their edges than in *Stemonurus,* the calyx is more distinctly 5-lobed, and the segments are imbricated in æstivation, a feature also recorded by

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* This species, and the details of its floral structure, will be exhibited in plate 15.

Blume in his character of *Platea* : in Griffiths's plant from Mergui, the calyx is furnished at its base, at the point of its articulation with the pedicel, with a distinct bract. In this plant, and in another from Moulmein, the flowers are axillary, and almost fasciculated in a very short raceme, but in Cuming's plant from Manilla, the inflorescence is in a spreading panicle, with numerous flowers upon lengthened pedicels. Blume, in his generic character of *Platea,* states that the flowers are diœcious, and that in the female flowers the corolla and stamens are altogether wanting. The same might almost be said of several species of *Stemonurus,* for as soon as the fertility of the ovarium is clearly discernible, the petals and stamens will be found to have fallen off, and from analogy we may safely conclude the same to have occurred in *Platea.* Mr. Griffiths in his manuscript note on *Phlebocalymna* says, "genus novum Icacinearum, familia singularis ob albumen in lobos divaricatos et tegumen seminis vasculosissimum:" this remark can hardly apply to his proposed genus, of which it does not appear that he had seen the seed, and it is more than probable that the allusion was made to *Bursinopetalum,* a genus placed by Dr. Wight (Icon. tab. 956) in the *Olacaceæ,* of which the *Icacineæ* had been universally held to be a tribe: in that genus, by the growth of the placentary column of the abortive cells, and its protrusion into the cavity of the fertile cell, the albumen becomes hippocrepically folded, and somewhat divided into two lobes, in the manner clearly demonstrated in the figure referred to. I have elsewhere shown that *Bursinopetalum* belongs to the *Aquifoliaceæ.* Blume in his 'Mus. Bot. Lugd.' gives a new generic character of *Platea* : this will require some modification, if we include in it *Phlebocalymna,* and with this view I now offer the following diagnosis:—

PLATEA, Blume. Phlebocalymna, *Griffiths.*—*Flores* hermaphroditi vel sæpissime abortu polygami: an unquam vere dioici? *Calyx* brevissimus, cupularis, 5-dentatus, dentibus in præflorationem imbricatis, persistens, sed non augescens. *Petala* 5, linearia, carnosula, æstivatione valvata, apice propendenti inflexo, marginibus rorido-glandulosis, imo in tubum laxe adhærentibus, e medio libera et reflexa, in flor. fem. fertil. cito decidua. *Stamina* 5, cum petalis inserta, iisdem alterna, *filamenta* interdum brevia, sæpe petalis fere æquilonga, linearia, compressa, imo cum petalis laxe adhærentia: *antheræ* ovato-oblongæ, basi breviter bifidæ, dorso affixæ, 4-loculares, 2-lobæ, lobis singulatim 2-locellatis, demum septicidis, et longitudinaliter evolutim dehiscentibus. *Pollen* globosum, reticulatum. *Ovarium sterile* disco 5-gono 10-striato piloso immersum; *fertile* liberum, conicum, pilosulum, disco annulari glabro insitum,

abortu 1-loculare, ovula 2 juxta apicem loculi subcollateraliter suspensa. *Stylus* brevis, sulcatus, pilosus, dentibus 3 stigmatosis erectis terminatus, demum in discum magnum sessile pulviniforme fructus coronans auctus. *Drupa* baccata, monopyrena, *putamen* oblongum, lignosum, angulato-rugosum, 1-spermum. *Semen* structuram Stemonuri æmulans?—Arbores *Asiæ tropicæ,* folia *elliptica, coriacea, glaberrima, vel juniora interdum subtus lepidota, breviter petiolata,* flores *perpauci in cymas vel racemos breves axillares dispositi, interdum fasciculati, sicce aurantiaci*: fructus *atro-purpureus.*

1. *Platea excelsa,* Bl. Bijdr. 646;—arbor 80–100 ped., foliis oblongo-lanceolatis, acuminatis, integerrimis, subtus cinereo-virentibus.—Java.

2. *Platea latifolia,* Bl. Bijdr. 646;—arbor 40–60-ped., foliis ovalibus, acuminatis, basi parum attenuatis, integerrimis, costatis, subtus griseo-lepidotis.—Java.

3. *Platea Sumatrana,* Bl. Mus. Bot. Lugd. Bat. 249;—foliis e basi obtusata vel rotundata elliptico-oblongis, acuminatis, subcoriaceis, venosis, subtus cinereo-virescentibus.—Sumatra.

4. *Platea Griffithsiana,* n. sp.;—ramulis substriatis, subrugosis, foliis oblongo-ovatis, e medio inferne paullo angustioribus, apice obtusiusculo breviter ac lineari-angustatis, coriaceis, utrinque pallidis et concoloribus, nervis inferne prominentibus, margine revoluto, petiolo brevi, canaliculato, racemo axillari, petiolo vix longiori, pedunculo pedicellisque aspero-pilosulis, floribus cum pedicellis articulatis, et hinc bracteatis; calycis glabri lobis ciliatis, petalis carnosulis, glabris, filamentis linearibus, compressis, imo latioribus, ovario brevissimo, sterili, disco pentagono immerso, stylo conico, piloso, dentibus tribus stigmatosis pube celatis.—Mergui.—*v. s. in herb. Lindl. et Hook.* (Griffiths, 849).

The leaves are 5¾ inches long, nearly 3 inches broad, on a deeply channelled petiole 4–5 lines in length; the raceme is about 7 lines long, few-flowered; the lobes of the calyx are distinctly imbricated; the petals conjoin by their margins in a tubular form, leaving the upper portion free and reflexed; the filaments for half their length adhere to the petals, but are easily separated, they are narrow, linear, compressed, and three-fourths of the length of the petals; the anthers are filled with pollen.

5. *Platea Lobbiana,* n. sp.;—ramulis angulatis; foliis ellipticis imo subacutis, apice obtusiusculo subito attenuatis, glaber-

rimis, coriaceis, supra lucidis, utrinque pallidis et concoloribus, costa supra sulcatis, nervis utrinque prominulis, venis immersis, margine valde revolutis, pagina inferiori minute cavo-punctatis, petiolo brevi, tereti, flavescenti, transverse rugoso, superne paullo canaliculato; racemo brevissimo, axillari, petiolo vix longiori, floribus subfasciculatis, sicce aurantiacis, hermaphroditis, calyce piloso, petalis linearibus, glabris; ovario piloso, ovuligero, disco annulari glabro insito.—Moulmein.—*v. s. in herb. Hook. et Lindl.* (Lobb, 385).

The leaves in this species are 4¾ to 5¾ inches long, and 1¾ to 2¼ inches broad, on a rather slender terete petiole about ¼ inch in length: the flowers are hermaphrodite; the lobes of the calyx are imbricated; the petals adhere by their margins in a tubular form, leaving the upper portions free and reflexed; the filaments for half their length cohere to the petals, but are easily separated, they are narrow, linear and compressed, nearly the length of the petals; the pollen is globular and reticulated; the style is hollow, terminated by three erect obtuse teeth; the ovarium is conical, hairy, seated on an annular glabrous disk; it is 1-celled, with two ovules collaterally suspended from near the summit of the cell.

6. *Platea Wightiana.* Gomphandra polymorpha, var. *Wight, Icon.* tab. 53;—foliis oblongis, apice obtusiusculo repente attenuatis, glabris; panicula axillari, divaricatim dichotomo-ramosa, folio 4-plo breviori, floribus aggregatis, staminibus exsertis, filamentis linearibus, apice latioribus.—Coonoor in Mont. Nielgherrensibus.

This is the plant to which I alluded when speaking of *Stemonurus* (*ante*, p. 88): although figured as the male plant of *Gomphandra polymorpha*, it would seem to be hermaphrodite, for the ovarium, as shown in the section given in fig. 6, is represented as ovuligerous.

7. *Platea laxiflora*, olim *Stemonurus laxiflorus*, n. sp.;—ramis flexuosis, nodosis, ramulis teretibus, subglabris, rugoso-striatis; foliis oblongis, utrinque acutiusculis, apice repente attenuatis, utrinque glabris et concoloribus, venis subtus prominulis, petiolo subtenui canaliculato; paniculis solitariis vel geminis, axillaribus, 3-chotomo-ramosis, et laxe divaricatis, pedunculis pedicellisque gracilibus parce pubescentibus, calyce corollaque glabris.—Ins. Philip.—*v. s. in herb. Hook. et Lindl.* (Cuming, 891).

The leaves are about 5½ inches long and 1¾ inch broad, on a petiole 5 lines in length; the panicles are about 1½ inch long, the peduncle and its widely spreading branchlets being long, slender, and nearly glabrous; the persistent calyx is smooth, with five small teeth; the petals are linear and thin in texture; these in the greater number of instances, together with the stamens, are wanting, having fallen away, as almost universally occurs in the female flowers of *Stemonurus* found in herbaria; and it is probably owing to this circumstance, that Prof. Blume, in his generic character of *Platea,* states that the female flowers are deficient of corolla and stamens. The stamens are the length of the petals, the filaments being quite free, very compressed and broad at the base, tapering above, thin, and almost membranaceous in texture, somewhat inflexed at their summit, where they are terete and affixed near the dorsal sinus of the anthers, which are oblong, 2-lobed, bifid and sagittate at base, and emarginated at the apex; the lobes are membranaceous, opened by a longitudinal fissure, the cells being quite void. The ovarium is cylindrical, as long as the stamens, and crowned with a sessile 5-lobed pulvinated disk, which is slightly umbilicated in the centre, where a short prominence is seen, this being the withered style and stigma: its single cell contains two large suspended ovules. It is worthy of remark, that in all the flowers retaining the corolla, I could find no instance in which the petals presented any appearance of opening, so that it is very probable that these, together with the stamens, in falling away retain the cylindrico-cupular form they present in the bud.

SARCOSTIGMA.

The following observations on the structure and affinities of *Sarcostigma* were completed in readiness for the press, when the last part of the 'Plantæ Javanicæ Rariores' made its appearance: in that important work we are favoured with an interesting account and an excellent figure of a new species of this genus from Java. The remarks there offered, in regard to the affinities of *Sarcostigma,* will be seen to be greatly at variance with my own deductions; and hence it becomes necessary that I should offer a few explanatory words on the subject. It would be presumptuous in me to attempt to contravene the inferences there deduced by the most profound botanist of our time, showing the relation which that genus bears to *Phytocrene, Nansiatum,* and *Iodes*; but fully acknowledging all that is there affirmed, I may venture to show, that a yet stronger and much closer extent of analogy will be found to exist in the structure and development of the floral parts, as well as a greater approximation in habit, to what we find in *Stemonurus* and *Pennantia.* From the facts shown below, it will be seen that *Sarcostigma* accords with nearly all the essential characters I have endeavoured to establish in the preceding series of memoirs, as the leading features of the *Icacinaceæ*, viz. trees with alternate, glabrous, coriaceous, petiolated, exstipulate leaves; an axillary racemose inflorescence, with small flowers, more or less polygamous, and distinctly articulated on a short pedicel; a small cupshaped, persistent calyx supporting the fruit, and unchanging with its growth; a corolla of four or five fleshy, linear petals, with valvate æstivation, arising from the hypogynous or stipitated support of the ovarium; free stamens, equal in number to, and alternate with the petals; introrse 2-lobed anthers; an ovarium presenting a similar form, the same internal structure, and the subsequent development of that seen in *Stemonurus* and *Pennantia*, and a fruit, in all appearance, closely analogous to that existing in those genera. Hence it seems evident from the facts here shown, that wherever *Pennantia*, *Stemonurus*, and *Platea* are placed in the system, *Sarcostigma* should follow in juxtaposition with them, unless the evidence now wanting, of the structure of its seed, should tend to a different location. If therefore *Sarcostigma* be found to hold a relation with the *Phytocreneæ*, the questions will naturally arise, whether this hitherto dubious family should not be brought into a more proximate position in the system with the *Icacinaceæ*, or whether I have been in error in referring the genus under consideration to the latter family. The group of the *Phytocreneæ* was first proposed by Endlicher as a suborder of the *Menispermaceæ*, a family with which they hold little relationship. Prof. DeCaisne, if I mistake not, first pointed out the identity of *Phytocrene* with the *Gynocephala* of Blume, a genus placed among the *Artocarpaceæ*: hence *Phytocrene* and *Nansiatum* were removed by Prof. Lindley and other botanists to that family. This conclusion appears to me to have been too hastily drawn, for the *Artocarpaceæ* differ from them essentially in their stipular leaves, the presence of only a single floral envelope, which is often imperfect or altogether wanting, in their having fewer stamens than the number of the lobes of its perianthium, in their bifid style, which is often basilar, in their ovarium, with only a single suspended ovule, which is amphitropal or orthotropal, and an exalbuminous seed, often erect, though sometimes pendulous, with a thickened testa, and thick, fleshy cotyledons, often unequal in size. *Phytocrene* is very different in habit from any of the *Artocarpaceæ*, having exstipulate leaves, flowers with a regular and symmetrical calyx and corolla, stamens equal in number to the petals, an ovarium with two anatropal ovules, suspended from the summit of the cell, and a seed with a considerable quantity of albumen, enclosing an embryo with large foliaceous cotyledons, and a small inferior radicle. In regard to the structure of the seed of *Phytocrene,* our evidence is yet quite uncertain. Prof. Lindley (Veget. Kingd. p. 274) describes and figures an albumen of a very granular, or rather ruminated texture, enclosing two large foliaceous cotyledons, with a very small inferior radicle; and Mr. Brown, in his generic character, greatly confirms this view, by stating it to possess an embryo with large foliaceous cotyledons, enclosed in albumen. Prof. Blume, on the contrary (Mus. Bot. Lugd. Bat. p. 41. tab. 7), describes and figures the embryo as being quite exalbuminous, with large foliaceous crumpled cotyledons of a rugosely granular texture, possessing a short superior radicle: he here acknowledges *Phytocrene* to be identical with his *Gynocephala,* the fruit of which he describes as consisting of an aggregation of several elongated drupes, upon a fleshy receptacle, forming a globe as big as a man's head. It must at the same time be acknowledged, that the extremely villous habit of *Phytocrene,* the peculiar structure of its woody stem, its closely aggregated flowers in globular heads, the membranaceous texture of its calyx and corolla, both clothed externally with very dense long hairs, and its peculiar stamens, present characters to which little resemblance can be traced in *Sarcostigma.* I urge these reflections, however, with extreme hesitation, in deference to the conclusions of an authority, whose determinations all botanists will regard with the highest consideration. It is to be regretted, however, that Mr. Brown has not favoured us with his views, and the reasons on which they are based, in regard to the real affinities of the *Phytocreneæ*; but he says decidedly that *Sarcostigma,* which in his opinion "so obviously belongs to" this group, bears no relation to *Hernandiaceæ,* to which family that genus had originally been referred by Drs. Wight and Arnott. We may, however, infer something more tangible on this point from his admission of "its near relationship" to *Pyrenacantha,* a genus with a single floral envelope, and other characters, that have led to its position near the *Antidesmeæ.* The genera *Phytocrene, Nansiatum,* and *Iodes* form a very natural group, possessed of consimilar features, offering constantly a regular calyx and corolla, divided into segments equal in number to the stamens, all alternating with each other in distinct series; they have therefore every claim to rank among the *Dialypetalæ* of Endlicher; but this disposition does not exist in *Miquelia,* a genus carefully figured and described by Prof. Blume (*loc. ante citat.*), and placed by him and Mr. Brown among the *Phytocreneæ*: this genus, with a very different habit, offers only a single floral envelope, with stamens alternate with its segments, and a 1-celled ovarium with two suspended ovules, characters similar to those of *Pyrenacantha,* from which it differs in its exalbuminous seeds: these two genera are therefore clearly referable to the *Apetalæ* of Endlicher, which are nearly equivalent to the *Monochlamydeæ* of DeCandolle. If *Sarcostigma* then be related to the *Phytocreneæ*,—an affinity which, if we accept, we must admit has not yet been demonstrated,—it is clear that it cannot bear any relation to the two genera before mentioned, which appear to have been associated with that group upon very insufficient grounds; and if, as above indicated, the *Phytocreneæ* be allowed to rank among the *Dialypetalæ*, it appears to me their position would not be far from the *Tiliaceæ* or *Dipterocarpeæ*, to which families they offer many analogous characters: from Prof. Blume's analysis, they would much resemble the latter in the structure of the seed; under Prof. Lindley's view, they would more nearly approach the former.

The observations that now follow were written several months ago, and as they are confined wholly to the description of facts, there is no occasion to retract anything there advanced in consequence of what is said above.

The genus *Sarcostigma*, to which I have alluded (*huj. op.* p. 53) as belonging to the *Sarcostigmeæ*, one of the tribes of the *Icacinaceæ*, was founded in 1832 by Drs. Wight and Arnott, on an Indian plant collected by Dr. Klein, and described by them in the 14th volume of the 'Edinburgh New Phil. Journal.' Like *Desmostachys*, it is somewhat scandent in its habits, but it has large oblong leaves upon very short petioles, and, as in that genus, it has an extremely long and slender spicated inflorescence, studded at close intervals with fascicles of small flowers, which in drying retain their bright yellow colour, and are very deciduous, being articulated upon very short and almost obsolete pedicels. The flowers, in the only case I have seen, are all female, and their stamens, which are sterile, are alternate with the petals; the internal structure of the ovarium corresponds with the usual character of the order: in the form of its epigynous stigmatoid summit it resembles *Stemonurus*, and what I have stated concerning the nature of this part in that genus appears confirmed by the circumstances that occur here: in some cases this appears like a flat, glabrous, fleshy disk, with a depression in the centre, as in the following genus *Discophora*, but it seems afterwards to attain the form of a somewhat conical umbraculiform process, overhanging the ovarium, with a crenated margin, and hollow in the centre. This process therefore, as in *Stemonurus*, would seem to be a growth subsequent to the period of impregnation: it will be remembered that a somewhat analogous succeeding development on the summit of the ovarium has been described in the case of *Apodytes*. In the rugous surface of its putamen, as recorded in the manuscript of Dr. Klein, it resembles *Mappia* and *Stemonurus*. Dr. Vogel collected another species, now first described, at Cape Palmas, on the Guinea coast of Africa; in its general appearance, the size and shape of its leaves, and in its singularly long, slender, spicated inflorescence, it bears a striking resemblance to Dr. Klein's plant and to that from Java, and although all the flowers have fallen off at the articulations with the pedicels, the identity of the genus cannot be mistaken. The following generic character has been derived, partly from my own observations as far as the specimen I have seen has afforded evidence, partly from Dr. Klein's original notes, and I have since added other features from Mr. Brown's description :—

SARCOSTIGMA, W. & A.—*Flores* polygami. *Calyx* minimus, breviter cupulatus, obtuse 5-dentatus, persistens. *Petala* 5, lineari-oblonga, glabra, imo disci stipitati adnata, æstivatione valvata, sub anthesi patentim reflexa, marcescentia et persistentia. *Stamina* 5, cum petalis inserta, iis alterna et æquilonga, in flor. fem. sterilia et subbreviora; *filamenta* linearia, compressa, in sterilibus apice antheris fere obsoletis 2-loba, (in fertilibus *antheræ* ovales, versatiles, loculis parallelis, approximatis, longitudinaliter dehiscentibus, sec. cel. R. Br.). *Ovarium* in flor. masc. parvum, sterile, pubescens, in flor. fem. cylindricum ventricosum pubescens, disco seu gynophoro brevi tereti stipitatum, 1-loculare; *ovula* 2 ex apice loculi subcollateraliter superposita, podospermio carnosa suspensa: (*stylus* brevis crassus et *stigma* capitatum sec. Klein:) in ovario adolescente, *stylus* nullus, nisi id quod videmus in discum sessilem stigmoideum umbraculiformem margine crenatum centro cavum demum mutatum, et *stigma* verum centrale proinde obsoletum. *Drupa* oblonga, compressa, monopyrena; *putamen* rugosum; cætera ignota.—Frutices *Asiæ meridionalis, Javæ, et Africæ tropicæ, subscandentes*; folia *majuscula, alterna, oblonga, coriacea, glaberrima, breviter petiolata*; racemi *longissimi, graciles, simpliciter spicati e fasciculis* 1–4-*floris alternis*; flores *minusculi, sicce flavi, cum pedicellis fere obsoletis articulati, et cito caduci.*

1. *Sarcostigma Kleinii*, W. & A. Edinb. New Phil. Journ. xiv. 299;—subscandens, glaberrima, laxe ramosa, ramulis teretibus; foliis oblongis, basi rotundatis vel subacutis, apice obtusiusculo acuminatis, et paullulo attenuatis (junioribus lanceolatis), coriaceis, supra pallidis, venis valde reticulatis prominulis, subtus stramineis, nervis venisque prominentibus, margine cartilagineo, petiolo subtenui, canaliculato, rugoso; racemo gracili, extra-axillari, folio magno multo longiori, floribus 1–4 minusculis, in fasciculis subsessilibus aggregatis,

articulatis, calyce pilosulo, drupa ovali, breviter pedicellata.—India Orientalis ad Travancore.—*v. s. in herb. Hook.* (*Wight*, 943, *cum descript. cl. Doct. Klein*).

The branchlets are slender and somewhat scandent; the leaves are of a pallid hue on both sides, but a little more yellow beneath; they are of a very coriaceous substance, rather polished, with raised reticulations above, the margins somewhat revolute and cartilaginous, with the nervures and reticulated veins very prominent beneath; they are 6 to 8½ inches long, 2¾ to 3¾ inches broad, on a short, deeply channelled petiole half an inch in length, and transversely rugous as in *Platea*; the raceme arises from the side of the stem opposite to that on which the petiole is inserted, as in some species of *Stemonurus*; it is about 11 inches long, very slender, and charged for nearly its whole length with clusters of few flowers, in which the calyx is somewhat pilose, but the petals are quite glabrous, and retain their yellow colour in drying; they are about a line in length. The drupe is supported by its calyx and corolla, both unchanged, withered, and persistent, upon the gynophorus, which is now elongated to a pedicel of the length of 1½ line; it is 11 lines long, and 7 lines broad when dried; a single drupe alone remains in the specimen referred to. Dr. Klein in his manuscript note says, that several aggregated lengthened racemes sometimes grow out of the leafless nodes of the old wood*.

2. *Sarcostigma Vogelii*, n. sp.;—suffrutex glaberrimus, ramulis teretibus, subrugosis; foliis majusculis, oblongis, utrinque acuminatis, apice acute et breviter attenuatis, coriaceis, glaberrimis, supra pallidis, subtus flavescentibus, nervis venisque reticulatis et transversis prominentibus, petiolo brevissimo, canaliculato, rugoso; racemo spicato, extra-axillari, longissimo, gracili, floribus subaggregatis, articulatis, caducis; drupa carnosa, rubra, pendula.—Guinea ad Cap. Palmas.—*v. s. in herb. Hook.* (Vogel, 25, 27 et 68).

This plant was collected in the Niger Expedition by Dr. Vogel, who describes it as a shrub (*strauch*): it bears very much the habit and appearance of the former species, but the leaves are not quite so thick in texture; they are smooth, somewhat undulating on the margins, 7 to 10 inches long, and 3 to 3½ inches broad, on a very short, channelled and rugous petiole, about 3 lines in length; the raceme is distantly extra-axillary, and inserted on the opposite side of the stem, as in the former species; it is 12 or 13 inches long, very slender, slightly pubescent and angular at base, for the length of about 3 inches, and in the remainder is glabrous and beset with alternate nodules, consisting of single or aggregated, very short pedicels, left bare by the falling away of all the articulated flowers. The fruit, according to Dr. Vogel's notes, is red, fleshy, oval and pendulous, and from his rough sketch of a transverse section it would appear to be somewhat compressed and to contain two seeds: if this be the case, it would bear out a still stronger analogy to the instance I have recorded in *Pennantia* *.

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* A drawing of this plant, with details of the structure of its female flowers, will be given in plate 18.

3. *Sarcostigma Horsfieldii,* R. Br. Pl. Jav. Rarior. 241. tab. 47. —Java.

DISCOPHORA.

The characters that warrant the establishment of this genus are few, but when taken in conjunction with the peculiar habit of the plant and the different country of its origin, they serve to mark its place. The specimen upon which it is founded is a native of Guiana, with ovuligerous flowers which are far advanced, for the petals and stamens are fallen away, leaving only the calyx and ovarium, which is crowned with a discoid process: in the internal structure of the ovarium, and the form of its persistent calyx, articulated on its pedicel, it is strictly conformable with other genera of this family; and in the peltoid disk that crowns the ovarium it resembles *Sarcostigma, Pennantia,* and *Stemonurus,* all of Asiatic origin; but in this case this process is much smaller and somewhat reniform. In one instance I found a single petal remaining, just sufficient to mark its character. As it cannot be referred to any one of the genera above mentioned, I propose to call it *Discophora,* from *δίσκος, discus, φέρω, fero.* The few characters known may be designated in the following manner:—

DISCOPHORA, gen. nov.—*Calyx* minimus, brevissime cupuliformis, fere integer, obsolete 5-denticulatus, persistens. *Petala* 5, linearia, glaberrima, textura tenui, nervo mediano longitudinali notata, cito caduca. *Stamina* ignota, mox decidua. *Ovarium* liberum, cylindricum, glabrum, 1-loculare; *ovula* 2, juxta apicem loculi superposita, podospermio crasso subcollateraliter suspensa, anatropa. *Stylus* cum *stigmate* confusus, demum subreniformi-discoideus, parvus, subconcavus. *Fructus* ignotus.—Frutex *Guianensis*; folia *alterna, oblonga, majuscula, glaberrima, petiolata*; racemi *axillares, divaricatim ramosi*; flores *parvi, cum* pedicellis *articulati.*

1. *Discophora Guianensis;*—omnino glaberrima, ramulis tere-

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* This plant is figured in plate 19 of this volume.

tibus, substriatis; foliis oblongis, utrinque acuminatis, apice lineari-angustatis, coriaceis, supra nitidis, nervis sulcatis, venis immersis, subtus fuscis, nervis rubentibus cum venis transversis prominentibus, punctis minutis resinosis notatis, margine revolutis, petiolo incurvo canaliculato; racemis axillaribus petiolo 2–3-plo longioribus, dichotome et divaricatim ramosis, pedicellis bracteatis, bractea oblonga obtusa crassiuscula pubescenti, floribus cum pedicello articulatis.—Demerara.—*v. s. in herb. Hook.* (*Parker*).

The branches are terete with a smooth bark; the axils are 1½ to 2 inches apart; the leaves are quite smooth, thick, and coriaceous, 8 inches long, 2½ inches broad, on a petiole of ½ to ¾ inch in length: a raceme about 1½ inch long springs out of each axil, sending out from the base upwards several alternate branches at nearly right angles, which are again divided; the branchlets and pedicels are slightly pubescent and furnished at their base with a short, obtuse, fleshy bract, covered with short fine hairs; the ovarium is 4 lines long, 1½ line diameter; the stigmatiferous disk is about one-third of the diameter of the ovarium; the calyx and petals are quite glabrous; the latter are linear, submembranaceous, marked with three parallel nervures, and are of a reddish-yellow colour when dry*.

EMMOTUM.

This neglected genus was proposed by Desvaux in 1825 upon a plant from Guiana. By Endlicher it was referred to *Leretia* of the 'Flora Fluminensis,' with which it neither accords in the appearance of the leaf nor the mode of its inflorescence: Hamilton's character as given in his 'Prodromus,' notwithstanding its brevity, is sufficiently well marked to show that it does not differ from *Pogopetalum*, founded by Mr. Bentham in 1840; indeed the *Emmotum fagifolium*, Desv., corresponds with *Pogopetalum acutum*, Benth., both from Guiana, so as to leave no doubt of their identity: according therefore to the austere rule of science, the latter name must give way to the former. Mr. Bentham in establishing his genus recorded two species, and has since described two others, and I have now to add a fifth. All the species, which are from Guiana and intertropical Brazil, seem to form good-sized trees, with very thick coriaceous leaves of a peculiar appearance; their inflorescence is in axillary crowded fascicles of rather small flowers, which are distinguished by having petals densely beset on their inner face with long red silky hairs arising from an elevated costal nervure. Their chief peculiarity, however, consists in the unusual structure and singular mode of dehiscence of their anthers, which are formed of two opposite, unilocular, valveless, and separate cells, the pollen being discharged extrorsely through a fissure arising from the secession of the dorsal margin of each boat-shaped cell from the very fleshy connective, features that have hitherto escaped observation. *Emmotum* offers also another peculiarity in its ovarium with three radiate cells, placed excentrically on the somewhat gibbous and anterior side of the ovarium. These points of structure are so different from the development met with in other genera of the *Icacinaceæ,* as naturally to lead to the suspicion that *Emmotum* may not belong to this family; but we must remember that in other respects it accords, viz. in its exstipulate alternate leaves, small flowers with a persistent unchanged calyx, petals with valvate æstivation, alternate stamens, simple style, and suspended collateral ovules. I have therefore retained the genus doubtfully, as a separate tribe of the *Icacinaceæ* (*ante,* p. 53), until its true place in the system can be ascertained, which will be determined by a knowledge of the structure of the fruit and seed and the form and position of its embryo. The name, I presume, has been derived from ἐν and μοτὸς, *linteum,* on account of the densely intertwined hairs that line the petals, a character that also suggested the name of *Pogopetalum.* These hairs, when examined under the microscope, appear flattened and covered with numerous prominent transparent glandular dots as in *Leretia.* The following is an outline of its generic features:—

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* A representation of this species, with analytical details, will be seen in plate 20.

EMMOTUM, Desv. Pogopetalum, *Benth.*—*Flores* perfecti. *Calyx* brevissimus, 5- rarius 4-dentatus, liber, fructifer immutatus. *Petala* 5, rarius 4, lineari-oblonga, carnosula, intus ad carinam longitudinalem pilis rufis sæpius longis et crispatis densissime barbata, æstivatione valvata, mucrone apicali introflexo. *Stamina* 5 vel 4, petalis alterna, iis vix breviora, omnino libera; *filamenta* carnosula dilatata, incurva, apice repente acuta; *antheræ* 2-loculares, *connectivo* crasso, interdum loculis utrinque sejunctis breviores, vel sæpe in mucronem subulatum incurvulum ultra loculos subantrorsim positos producto, imo cordato affixæ, *loculis* membranaceis, cymbæformibus, evalvibus, margine posteriori a connectivo omnino soluto hinc extrorsim dehiscentibus. *Pollen* ovale, longitudinaliter sulcatum. *Ovarium* liberum, oblongum, subgibbum, pilosum, disco hypogyno parvo sistens, 3-loculare, loculis excentrice radiantibus; *ovula* in quoque loculo 2, juxta apicem appensa et subcollateraliter superposita. *Stylus* excentricus, erectus, teres. *Stigma* e dentibus 3 brevissimis erectis minutum. *Drupa* globosa, abortu

1-locularis; cætera ignota.—Frutices Guianenses et Brasilienses *sempervirentes*; folia *alterna, exstipulata, coriacea, integra, nitida, subtus tomentosa*; cymæ *fasciculatæ, axillares, multifloræ*; flores *parvi, aggregati, cum pedicellis brevissimis articulati, bracteati.*

1. *Emmotum orbiculatum.* Pogopetalum orbiculatum, *Benth. Linn. Trans.* xviii. 685. tab. 42;—arbor 2-orgyalis, ramulis cinereo- vel fulvo-tomentosis, foliis ovato-orbiculatis, apice brevissime ac obtusissime acuminatis, coriaceis, nitidis, supra lucidis, rachi tomentoso, nervis parallele incurvo-divaricatis, venis creberrime transversis immersis, subtus cum petiolo crasso profunde canaliculato incano- vel fulvo-tomentosis; ovario hispido, fructu globoso, calyce immutato suffulto.—In Guiana Brasiliæ ad fluv. Padauri, confl. fluv. Nigri.—*Schomburgk.*—(*v. s. in herb. Mus. Brit. et Hook. fructu immaturo, Rio Preto, Prov. Pernambuco.*—Gardner, n. 2941.)

This species is remarkable for the shape of its leaves, which are almost orbicular at the base and summit, are 2¾ to 3¼ inches long, 2½ inches broad, on a deeply grooved petiole 6 or 7 lines in length; they are thick and coriaceous, very polished above, with a finely shagreened surface, and densely covered beneath with short yellowish tomentum: the simple racemes with a few immature drupes are about ¾ inch long.

2. *Emmotum acuminatum.* Pogopetalum acuminatum, *Benth. loc. supr. cit.* 685;—arbor 5-orgyalis, foliis ovatis oblongisve, apice longissime et anguste attenuatis, mucronulatis, coriaceis, fusco-rufulis, supra lucidis et glaberrimis, in costam sulcatis, nervis paucioribus vix prominulis, venis transversis immersis, subtus pallide ferrugineis, glandulis minutis creberrime punctatis, pube rara instructis, petioloque sulcato leviter pubescentibus, demum glabris; racemis geminis, floribus aggregatis griseo-pilosis, petalis ovali-oblongis, intus in carinam pilis longis rufis lanatis, marginibus utrinque glabris; ovario pilis destitutis et e glandulis minutissimis asperis glauco-pruinoso, disco glabro insito; stylo excentrico elongato, stigmate obsolete 3-dentato.—Rio Negro, Brasiliæ (Schomb. 970).

The branchlets are somewhat compressed and angularly striated: it is however distinguished from the other species by the long attenuated summit of the leaves, which are also of a remarkably dark copper or reddish colour when dried; they are about 4 or 4½ inches long, including the suddenly narrow apex of half an inch in length; they are 1¾ to 2½ inches broad, on a petiole 5 lines long; the nervures, about seven pairs, are parallel, very divergent, curving, with finely reticulated transverse veins;

the upper surface is polished and finely shagreened; beneath they are of a ferruginous hue, dead, almost glabrous, and when viewed under the lens seem covered with minute raised glandular dots: generally two racemes spring out of each axil, from ½ to ¾ inch long, which, when younger, appear like a crowded globular axillary fascicle. The anthers in structure resemble those of the following species. The long red hairs that densely spring from the inner keel of the petals under the lens appear marked by large prominent glands in two uneven series, so that they seem almost torulose.

3. *Emmotum fagifolium,* Desv. in Ham. Prodr. Fl. Ind. Occid. p. 29. Pogopetalum acutum, *Benth., Hook. Lond. Journ. Bot.* ii. 377;—ramis angulatis, rufo-tomentosis; foliis oblongis, ovatisve, apice repente lineari-attenuatis, basi rotundatis vel truncatis, valde coriaceis, supra sublucidis, glaberrimis, nervis divaricatis, pubentibus, approximatis, incurvo-parallelis, sulcatis, venis transversis immersis, subtus præsertim in nervis sparse sericeo-pubescentibus, nervis tenuibus subprominulis, petiolo canaliculato tomentoso; racemis geminis, axillaribus, petiolo vix longioribus, floribus aggregatis, aurantiaco- vel cano-tomentosis, petalis lineari-oblongis, intus pilis longis rufis in carinam lanatis, lateribus glabris, filamentis tenuioribus, dilatatis, antheris ovatis, vix mucronulatis, loculis oppositis, complanatis, ovario pilis longis hispido (nec glabro), stylo elongato, gracili.—Guiana Gallica, Desvaux.—*v. s. in herb. Hook.* (Leprieur et Martin).

There can be little doubt that this is the plant described by Desvaux as the "*Bois d'Agouti,*" and which is identical with the *Pogopetalum acutum* of Mr. Bentham: the leaves in form much resemble those of the preceding species; they are from 3¾ to 6¾ inches long, and 2¼ to 3¾ inches broad, on a slender petiole half an inch in length; the apex is very suddenly acuminated by a linear point, half an inch in length, and often little more than a line in breadth. The flowers are closely aggregated, each being articulated on its short pedicel; the calyx is cupuliform, pubescent, and cleft into five ovate, fleshy and somewhat acute lobes, which are slightly imbricated in æstivation, as in *Platea*; the petals are clothed outside with short grey adpressed hairs, and the prominent internal keel is furnished with a line of very densely-set long red spreading woolly hairs, which are flattened and marked with glandular dots; the stamens are nearly as long as the petals; the filaments are fleshy, compressed and broader at the base, somewhat terete and subulate above, and suddenly bent back at the apex, where the point is affixed to the front of the red fleshy connective, just above its short basal sinus; the anthers are therefore strictly extrorse; the connective is almost terete, somewhat compressed, erect in position, and about one-sixth of the length of the filament; the two anther-cells are distinctly separate, thin, membranaceous, white, flattened, boat-shaped and valveless, fixed one on each side of the connective; they are longer both above and below, so that the anthers are emarginated at the apex and base; they generally open extrorsely by the separation of the posterior margin of the cells from the connective, or they sometimes, though rarely, separate by both margins. The ovarium has been described as being glabrous, but I have constantly found it clothed with long, erect, setaceous, shining, white hairs; the lower part is invested by a glabrous, adnate, cup-shaped disk: the style is erect and somewhat bent, glabrous, rather subulate, slender, and of the length of the stamens: there is no apparent stigma, but the apex of the style is hollow and crowned with three very minute teeth: the ovarium contains three radiate, excentric cells, each showing two ovules suspended from near the apex.

4. *Emmotum affine*, n. sp. Pogopetalum affine, *Planch. MSS.*;—foliis ovalibus e basi rotundato gradatim angustioribus apice fossulato et deflexo longe attenuatis, subconvexis, supra nitentibus, costa sulcatis, nervis subprominulis, venis creberrime transversis immersis, subtus ferrugineis, et glauco-pruinosis e pilis brevissimis adpressis sub lente visuris, margine valde reflexo, petiolo subtenui sulcato rufo-glaucescente; racemis axillaribus, floribus aggregatis cano-pilosis, petalis intus in carinam pilis longissimis rufis dense lanatis lateribus glabris: staminibus spec. præced.: ovario piloso, disco glabro insito.—Brasilia.—*v. s. in herb. Hook.* (Sellow.)

This species comes very near *E. acuminatum*; the leaves are very shining above as in that species, and ferruginous beneath, but the hairs that clothe its under surface are so minute as to be seen only under a strong lens; they are somewhat convex above and the margins are very revolute, the attenuated apex being deeply channelled and curved downwards; they are about 4¼ inches long and 2 inches wide, with a somewhat slender and almost terete petiole, which is often suddenly deflexed. The inflorescence is axillary in a few of the upper leaves, but is mostly terminal in branching alternate racemes, each about three-quarters of an inch long.

5. *Emmotum nitens*. Pogopetalum nitens, *Benth. loc. citat.*;—ramis striatis; foliis oblongis, acuminatis, coriaceis, supra glaberrimis, pallide glaucis, sub-nitentibus, subconvexis, nervis subprominulis, venis transversis immersis, subtus pube sericea

adpressa densa incana aut fulva vestitis, nervis valde prominentibus, margine reflexo, petiolo elongato cano-tomentoso canaliculato sæpe deflexo; paniculis racemosis, ternis, axillaribus, petiolo sublongioribus, floribus dense aggregatis, griseo-pilosulis, petalis lineari-lanceolatis, acutis, summo patentim reflexis, intus ad carinæ basin apicemque fasciculo pilorum donatis, pilis brevibus albidis; staminibus incurvis crassiusculis, connectivo tereti, imo cordato, in mucronem obtusum incurvum longe protenso, antherarum loculis sejunctis, antice contiguis, subparallelis, margine dorsali dehiscentibus; ovario pilis brevibus micantibus adpressis vestito, disco glabro insito; stylo brevissimo valde excentrico.—Brasilia intertropica.—*v. s. in herb. Hook.—Prov. Goyaz, Minas Geraës et Pernambuco* (Gardn. n. 2941, 3309, 4451); *Rio S. Francisco* (Blanchet, 2889).

In this species the leaves, in the dried state, present a remarkably pallido-glaucous and lurid aspect above, and are covered below with yellow, very short, adpressed and bright tomentum; the upper surface is shining, with prominent nervures, and under a lens appears marked with numerous minute impressed dots, between which are seen still more numerous raised resinous spots; they are generally about 4 inches long and 2 inches broad, on a longer and more slender petiole, about 9 lines in length. One, two or three short branching racemes, about the length of the petioles, crowded with numerous flowers, spring from each axil; the stamens are incurved, about the length of the petals, the anthers being nearly as long as the broad fleshy filaments; the thick, fleshy, almost terete connective is slightly cordate at its base, is somewhat incurved and subulate, and terminates in an obtuse point that much exceeds the length of the anther-cells; this is affixed just in the angle of its sinus in front, to the obtuse apex of the filament, so that the anthers, though at first sight apparently basifixed, are in reality also extrorse in position: the anther-cells are white, of thin texture, linearly boatshaped, quite separate, nearly parallel, and fixed extrorsely upon the sinus of the inner face of the connective, and they discharge their pollen by the secession of the exterior margins from the body of the connective. The pollen is oval, marked by three longitudinal lines. The ovarium is shorter than the stamens, covered with short erect hairs, and seated on a small fleshy glabrous disk; it is 3-celled as in the last-described species; the style is very short, very excentric, hollow at its apex, and terminated by three very minute teeth.

On the Canellaceæ.

Having been engaged for a long time in the study of the *Clusiaceæ,* I have been led to examine the several genera that have been referred at different periods to that family, and in this manner *Canella* and *Cinnamodendron* came under my especial notice. The former genus was arranged by DeCandolle and Choisy in *Guttiferæ,* but it was partially separated from the order by Martius and Endlicher, and made the type of a suborder of that family under the name of the *Canellaceæ,* associating with it *Cinnamodendron* and *Platonia.* It will, however, be seen that *Canella* has no relation with *Platonia,* but that its real affinity tends towards the *Winteraceæ.* I will therefore proceed to state my reasons for this conclusion, will expose the characters of both groups, and describe their genera severally.

This small family consists only of the two genera above mentioned, *Canella* and *Cinnamodendron.* They form evergreen trees, with a bark possessing the taste and smell of cinnamon; they have a copious foliage of alternate, somewhat fleshy, exstipulate leaves, which are furnished with dotted glands, and have a taste similar to that of the bark: the flowers are small, in short axillary or terminal corymbs, having a persistent calyx of 3 sepals, 5 petals with dotted glands, or sometimes 10 petals in 2 series, extrorse monadelphous stamens, a unilocular ovarium with two or more parietal placentations; a small, baccate, 1-celled fruit, containing a few black, shining, reniform seeds having a parietal attachment. Many of these characters are possessed by the *Winteraceæ,* from which the *Canellaceæ* differ in the union of their stamens into a monadelphous tube; in the shape and disposition of the anther-cells; and in lieu of several distinct carpels, they have only one solitary unilocular ovary, with 2 to 5 parietal placentations. In the former family, whether there be several ovaria, or whether by abortion they be reduced to one, these, although 1-celled, invariably exhibit a single placentation along the ventral face.

1. Canella.

The plant upon which this genus was founded was first described by P. Brown in his 'History of Jamaica.' During a long time it was considered to belong to the same genus as *Drimys Winteri,* a small tree growing in Tierra del Fuego, near the Strait of Magellan; for the bark of both species had for some time been used in commerce, as mentioned by Clusius in 1605, under the name of *Cortex Winterana,* and confounded with the white bark *Canella alba,* a name afterwards given exclusively to the Jamaica kind. By Linnæus the latter was also considered to be the produce of a species of *Wintera* (*W. alba*, L.). Murray, in his edition of Linnæus's 'Syst. Veg.,' appears to have first distinguished it generically from the Magellanic species, calling it *Canella alba*, a name by which it has since been universally known. The earliest details of its general characters were furnished in 1788 by Swartz, in a memoir published in the first volume of the Linnæan Transactions; and in the same year, Gaertner described the structure of its seed and embryo. Swartz, however, was correct in stating its berry to be unilocular, and from 2- to 4-seeded; but Gaertner, generally so accurate in his observations, erred by adopting the character of Linnæus, who characterized it as being 3-celled,—an error which has been perpetuated by most botanists to this day, notwithstanding that its true structure was subsequently indicated by Cambassèdes.

Jussieu, in his 'Genera Plantarum' (in 1789), referred *Canella*, together with *Symphonia*, to the simple-leaved section of the *Meliaceæ*; but subsequently*, in his observations upon this family (1817), he excluded it altogether from the Order, on account of its seminal structure and the character of its leaves.

Choisy (in 1823) referred the genus to the family of the *Guttiferæ*, because of its monadelphous stamens, which appeared to him sufficient to establish a relationship with *Symphonia* (*Moronobea*), an idea first indicated, but soon abandoned by Jussieu; and in the following year (1824) the same position was again assigned to it by Choisy in DeCandolle's Prodromus (i. 563).

By Nees and Martius (1825) it was still referred to *Meliaceæ*, together with a new species from Brazil†, to which they gave the name of *Canella axillaris*, which plant was afterwards made the type of a new genus, *Cinnamodendron*, by Endlicher‡.

Cambassèdes (in 1828) exposed the fallacy of the ground upon which *Canella* had been placed by Choisy among *Guttiferæ*, and first pointed out the real structure of the ovary in this genus§; but his observations have been neglected by succeeding botanists.

Adrien de Jussieu (1830), in his monograph of the *Meliaceæ*, offered valid reasons|| for its exclusion from that family, as well as from the *Guttiferæ*, without assigning, however, any positive locality for this genus.

Prof. von Martius (1829), in his 'Gen. et Spec.' iii. 163, described at some length and figured a new genus, *Platonia*, founded on another Brazilian tree having much the habit of the *Guttiferæ*. This genus he proposed to associate with *Canella* in a new family, the *Canellaceæ*, which he placed next to *Guttiferæ*,

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* Mém. Mus. iii. 347.

† Nova Act. Acad. Cæs. xii. p. 18. tab. 3.

‡ Gen. Plant. p. 1029.

§ Mém. Mus. xvi. 395.

|| Mém. Mus. xix. 185.

which view was adopted by Endlicher in his 'Genera Plantarum,' who then added to it his new genus *Cinnamodendron*.

Prof. Lindley (1836), in his 'Introduction to Botany' (p. 76), followed the example of Endlicher in adopting the *Canellaceæ*, and in placing it next to *Guttiferæ*; but subsequently (in 1846) he changed his views, removing the former family as a suborder of the *Pittosporaceæ**, and considering the *Canellaceæ* as intermediate between it and *Olacaceæ*.

Richard† suggested its affinity with the *Ternstrœmiaceæ*.

Choisy (1850), in his last review of the *Clusiaceæ*‡, has somewhat modified his former view by adopting the suggestion of Richard, and in placing this small group as a suborder of the *Ternstrœmiaceæ*, an affinity that can be justified only as regards *Platonia*, which genus, though of proximate relationship, cannot be referred to that family§.

In the midst of such conflicting authorities, it appeared to me desirable to search for more certain grounds on which to base the true affinities of this small group: it is now some time since, with this view, I investigated carefully the structure both of the flower and seed; and this examination led me to place it in a position very different from any yet assigned to it, for it appears to me that the *Canellaceæ* must range close to *Drimys* and its congeners, as I shall proceed to show.

The details of the structure of *Canella*, as originally given by Swartz‖, are tolerably correct: the flower has three persistent, imbricated sepals; five deciduous fleshy petals imbricated in æstivation; its stamens are united into a fleshy, monadelphous tube that entirely encloses the pistil, the anthers consisting of 20 distinct linear cells, which are affixed extrorsely upon it; the ovary is 1-celled, and furnished with two opposite parietal placentæ, which arise from the base, and upon each of these in the middle are seen two reniform ovules attached horizontally right and left by a short and broad funicle in the sinus. The fruit, like that of *Drimys*, is baccate and unilocular, containing four slightly reniform, oval, rounded seeds, enveloped in a syrupy, aromatic mucilage; their external tunic forms a hard, shining, black, crustaceous shell; and on the ventral face, just above its sinus, is seen an open scar or hilar spot, indicating the point of its suspension; while a little above this is a small obsolete prominence, corresponding with an internal point, to which the enclosed nucleus is attached. On breaking this internal tunic, the nucleus is found covered with a tolerably thick coating of a loose tissue, in which is imbedded a short thread-like raphe enclosing spiral vessels, proceeding from the point of attachment just mentioned, and terminating in a thickening of the proper integuments seen on the ventral face, just below the sinus. This envelope of loose texture is quite analogous in its structure to a similar development in the seed of *Drimys*, which I have elsewhere more minutely described, differing only in its component cells being filled with mucilaginous instead of fatty deposits; the origin, course, and termination of the raphe being alike in both cases: so also the innermost integuments are similar in texture to those of *Drimys*, and though slightly agglutinated together, are separable at all points except about the spot where the raphe terminates in a broad, circular, dark, areolar thickening of their substance, where they are intimately connected. The position and direction of the embryo, in very copious albumen, offer other striking points of resemblance; although the embryo is much larger and more elongated in *Canella*, and more minute in *Drimys*, still the cotyledons in the former, though proportionally longer, are terete, and the extremity of the radicle in both cases is closely contiguous to the point of suspension of the seed. One feature, worthy of especial notice, is even more strongly developed here than in *Drimys*: the direction of the embryo does not correspond with the axis of the albumen; nor do the cotyledons tend towards the chalaza, but lie on the contrary side, in quite an excentrical position. I have observed in *Canella*, as well as in *Drimys*, within the body of the albumen, the remains of the embryo-sac extending from the cotyledonary extremity of the embryo, surrounded by soft mucilaginous matter. From the above facts we may draw the same conclusion in regard to the nature of these several tunics of the seed in *Canella* that I have done in that of *Drimys*,—viz. that the external crustaceous tunic, being quite free from the raphe which is imbedded in a more internal envelope, must be a development subsequent to the growth of the true coats of the ovule, and that it is in reality an arillus: that the intermediate tunic in which the raphe is imbedded is the arilline or fleshy testa*, while the innermost integument immediately covering the albumen is the tegmen, as shown by its areolar thickening at the chalaza.

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* Veg. Kingd. 442.

† Flore de Cuba, p. 245.

‡ Mém. Soc. Phys. Genève, xii. 381.

§ This genus I consider to belong to the *Moronobeaceæ*, a group I propose to separate from the *Clusiaceæ*, and which will comprise *Moronobea*, *Chrysopia*, *Platonia*, and two new genera,—*Perissus* (the type of which is *P. lucidus*, from Rio Negro, Spruce, 2159), and *Catalissa* (founded upon *C. Blanchetiana*, from Bahia, Blanchet, 1671). In a memoir yet unpublished, I have described all the above genera and their species, giving at the same time the characters and affinities of the Order, which I consider to be intermediate with the *Ternstrœmiaceæ* and *Hypericaceæ*.

‖ Linn. Trans. i. p. 99. tab. 8.

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* Linn. Trans. xxii. 81.

The characters of the genus, as I have observed them, may be defined thus:—

Canella, *Murray, Linn. Syst.*; *P. Brown. Jam.* 215; *DC. Prodr.* i. 563; *Endl. Gen.* 5457. Winterana, *Linn. Gen.* 598.—*Sepala* 3, suborbiculata, concava, coriacea, margine ciliata, suberecta, persistentia, æstivatione imbricata. *Petala* 5, uniseriata, sepalis fere duplo longiora, oblonga, concava, crasso-carnosa, erectiuscula, quarum 2 paullo angustiora et interiora, decidua, æstivatione imbricata. *Stamina* in tubum cylindricum petalis æquilongum monadelpha, *tubo* carnosulo e disco parvo scutelliformi hypogyno producto, apice ultra antheras breviter extenso, ibidem tenuiori et pellucido-punctato, margine fere integro aut subcrenulato; *antheræ* extrorsæ, e locellis 20 subæqualibus dorso omnino adnatis, linearibus, compresso-angustis, parallelis, sejunctis, rima media longitudinali 2-valvatim dehiscentibus: *pollen* reticulatum. *Ovarium* superum, cylindricum, vel conico-oblongum, glabrum, 1-loculare; *ovula* 4 reniformia, e medio ad placentas 2 oppositas longitudinales parietales per paria collateralia horizontaliter appensa, *funiculo* brevi in sinu affixa. *Stylus* crassus, ovario continuus et æquilongus, os tubi attingens. *Stigma* truncatum, obsolete bilobum. *Bacca* ovata, carnosa, calyce immutato suffulta, stylo breviter apiculata, 1-locularis. *Semina* 4, in mucilaginem condita, rotundato-ovata, subreniformia, hilo minusculo cavo sub apicem notata; tunica externa (*arillus*) dura, crystallino-crustacea, lævis, nitida, sub lente confertim granulata, atra; tunica intermedia (*testa arillina*) externa conformis, sub apicem apiculata, et hinc ad illam paullo super hilum affixa, membranacea, latere ventrali ab apice usque ad medium *raphide* filiformi percursa; *integumentum internum* crassiusculum, obscurior, *chalaza* majuscula ventrali notatum. *Embryo* in verticem *albuminis* copiosi carnosi et eo 4-plo brevior versus faciem dorsalem reconditus, hinc valde excentricus, teres, curvatus; *radicula* extremitate crassiori hilo proxima, *cotyledonibus* semiteretibus chalaza aversis æquilonga.

Arbores *Antillanæ et Columbianæ sempervirentes summo ramosæ;* folia *alterna obovata vel oblonga, coriacea, juniora pellucido-punctata, glabra, integerrima, superne nitida, petiolata, exstipulata:* inflorescentia *terminalis, corymbosa,* floribus *subparvis, albido-violaceis.*

1. *Canella alba,* Murray, Linn. Syst. iv. 443; P. Brown, Jam. 275. tab. 27. fig. 3; Catesby, Carol. ii. tab. 50; Swartz, Linn. Trans. i. 96. tab. 8; DC. Prodr. i. 563. Canella Winterana, *Gaertn.* i. 377. tab. 77. Winterana canella, *Linn. Sp.* 636;

Lam. Dict. viii. 799. tab. 399;—arborea, 10-orgyalis et infra, cortice griseo gusto cinnamomi donata; foliis oblongo-obovatis, integerrimis, nitidis, crassiusculis, tenuiter anastomoso-nervosis, pellucido-punctatis, vetustioribus opacis, subtus pallidioribus, petiolo crassiusculo canaliculato; corymbo terminali folio sub-breviori; pedicellis flore æquilongis, petalis violaceo-albis.—In Antillanis.—*v. s. in herb. e Jamaica, Cuba, et viv. in hort. Kew. cult.**

This tree, of which a history has been given in a preceding page, seems to have been confounded to this day with a kind of *Cinnamodendron* presently to be described. I am led to believe that the true *Canella alba* grows chiefly in the forests of the mountains of Jamaica, where its upright trunk attains a height of 50 or 60 feet, with terminal abundant foliage; while the *Cinnamodendron* just alluded to rises in the plains, forming a branching shrubby tree, from 10 to 15 feet in height. It remains to be seen whether the *Canella* described as existing in the Bermudas and other West India Islands be identical with it, or whether it be a distinct species. The specimens I have seen from the island of Cuba appear specifically the same as those from Jamaica. The bark taken off the branches for commercial purposes is double, the outer one being grey, and of the thickness of a shilling, while the inner bark, sought after by druggists, under the name of *cortex Canellæ albæ*, is double that thickness, of a paler colour, and of a more pungent and aromatic taste. The leaves are about 5 inches long, 1¼ inch broad, on a petiole about 4 lines in length. The corymb, much branched, seldom exceeds 1 or 1½ inch in length; the pedicels are 3 lines long; the orbicular sepals 2 lines in diameter; the petals about 3 lines long; the staminal tube about the same length; the 20 anther-cells, little more than a line long, are equidistant from each other, separated by a very narrow interval, and open by a medial line along their whole length. The berry is oval, about 5 lines long and 4 lines in diameter; it generally bears 2 to 4 seeds, which are black, shining, 2½ lines long, 1¾ line in diameter, and are somewhat reniform on the ventral face.

There appears to be still another kind of *Canella*, but whether a mere variety, or a distinct species, remains to be ascertained. It is mentioned by G. Don (Dict. i. 680) under the name of *C. laurifolia*, as forming a tree 15 feet high, and growing in the West Indies. Plants of it were raised from seed at Hackney by Loddiges in 1817 (Lodd. Cat.). It has terminal flowers, as in

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* A figure of this species, with structural details, will be given in plate 23 A. of this volume.

Canella alba; but its leaves are narrower, more lanceolate, considerably longer, and of a much paler green colour. The plant cultivated at Kew under the name of *C. alba* quite corresponds with that described by Don; its leaves are 3½–4½ inches long, 1–1¼ inch broad, upon a much stouter petiole 4 lines in length; they are tapering at both ends.

2. *Canella obtusifolia*, n. sp.;—ramulis teretibus, rugosis, cortice aromatico tectis; foliis obovatis, apice rotundis, e medio versus petiolum cuneatis, integerrimis, supra nitidis, subtus pallidis, crassiusculis tenuiter anastomosanti-nervosis, pellucido-punctatis, margine revoluto, petiolo sub-brevi, tenui, semitereti, superne plano: corymbo paucifloro terminali, folio multo breviori; bacca minori, ovata, stylo apiculata et calyce suffulta.—Maracaibo.—*v. s. in hb. Mus. Paris* (Plée, 720)*.

The specimen upon which the above species is founded has no flowers; but there can be no doubt that it is really a *Canella*, because of its terminal flowers, while in the two species of *Cinnamodendron* the flowers are constantly axillary. The berry and seeds are also quite those of *Canella*, and differ in shape, size, and appearance from those of the genus just mentioned. The leaves are 2 to 2½ inches long, including a petiole of 3 lines, and are 12–14 lines broad. The inflorescence is very much smaller than in the preceding species, where it forms a broad spreading panicle, partly terminal, and partly axillary at the two ultimate leaves, rather more than an inch long, and 2 inches broad: this panicle is ternarily branched in three or four subdivisions; the first or main peduncle is 4 to 6 lines long; the secondary pedicels are 3 lines, and the tertiary pedicels, each supporting a flower, are 4 lines in length. On the other hand, in *C. obtusifolia*, the raceme is quite terminal, simple, few-flowered, and only 4 lines in length, the main peduncle being 2 lines, and each pedicel 1½ line long, the berry being less in size than that in the preceding species; it is 4 lines in length and 3 lines in diameter: the one I examined contained only two seeds, lying horizontally and superimposed, one apparently from each placenta, and filling the whole space of the cell, where they are surrounded by a small quantity of thin glutinous mucilage. The seeds are black and shining, and are constituted precisely as in the species before described.

2. Cinnamodendron.

This genus was proposed by Endlicher† for a Brazilian plant first described by Nees and Martius, under the name of *Canella*

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* This species, with analysis of its fruit and seed, will be shown in plate 23 B.

† Gen. Plant. 5458.

*axillaris**, since which, nothing has been recorded respecting it. I have lately had an opportunity of examining that plant, and find the details above referred to sufficiently correct; but the evidence I have now to communicate, regarding a second species, establishes beyond doubt the validity of the genus, and its close affinity to *Canella*. This second species has so much resemblance to *Canella alba* in its general characters, especially in the similar properties of its bark, that the two have been confounded together in commerce. It differs, however, in having axillary flowers, while in *Canella* they are terminal: they agree with one another in their odoriferous and aromatic qualities, in the number and form of their persistent sepals, in the union of their extrorse stamens into a monadelphous tube, in the number and shape of their anther-cells, and in the size and shape of their ovary and style; but *Cinnamodendron* differs from *Canella* in its rotate calyx and corolla, in the presence of an inner row of petals, in a different stigma, in the number of its parietal placentations, in the great number of its ovules, and its much smaller and more numerous seeds. In the specimen I examined of Martius's plant, I could not determine the number of its placentæ, as the flowers were in bud, and the ovary consequently in a very early stage of development; but in the Jamaica species I have found that the placentations are generally 5, sometimes reduced to 4, the number of ovules being very considerable: in *Canella*, on the other hand, the placentæ are constantly 2, and the number of ovules does not exceed 4, all of which, or sometimes only 2, are matured into seeds. I have remodelled its generic characters in the following manner:—

CINNAMODENDRON, Endl. (Char. reform.) *Sepala* 3, orbiculata, rotatim expansa, coriacea, margine ciliata, persistentia, æstivatione imbricata. *Petala* 10, biseriata; 5 exteriora oblonga, sepalis dimidio longiora, carnosa, expansa, æstivatione imbricata; 5 interiora membranacea, spathulato-oblonga, pellucido-punctata, exterioribus alterna et vix æquilonga, iisque erectiora: omnia decidua. *Stamina* in tubum cylindricum petalis æquilongum monadelpha, *tubo* tenui e disco parvo scutelliformi hypogyno producto, longitudinaliter 10-nervio, pellucido-punctato, margine ultra antheras breviter porrecto et hinc brevissime 10-lobo, sinubus cum nervis alternantibus, lobis vix retusis; *antheræ* extrorsæ, tubi dimidio longitudine, locellis 20 subæqualibus, dorso omnino adnatis, linearibus, compresso-angustis, parallelis, sejunctis, rima media longitudinali 2-valvatim dehiscentibus, valvibus tenuibus nigro-punctulatis; *pollen*

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* Nov. Act. Acad. Cæs. xii. p. 18. tab. 3.

globosum, reticulatum. *Ovarium* superum, cylindricum, glabrum, 1-loculare; *ovula* plurima, reniformia, horizontalia, e sinu ventrali ad placentas lineares parietales sæpius 5 (rarius 4) demum incrassatas et carnosas appensa. *Stylus* crassus, ovario continuus et vix angustior, tubum stamineum attingens, vel paullulo ultra exsertus, brevissimus, obtusus: *stigmata* sæpius 5 (rarius 4) peltato-glandulæformia, margine fimbriata, summo styli extus adnata. *Bacca* ovata, carnosa, calyce immutato suffulta, stylo breviter apiculata, 1-locularis, placentis parietalibus 5 carnosis prominulis axin non attingentibus seminiferis munita. *Semina* (circiter 10) in mucilaginem condita, ad placentam per paria funiculo brevi horizontaliter appensa, cum plurimis semi-abortivis mixta, clavato-reniformia, tuberculata, compressa, subnitida, granulata, *hilo* ventrali minusculo sub apicem notata: tunica externa (*arillus*) crystallino-crustacea, fragilis, fusca; tunica intermedia (*testa arillina*) lævis, sub apicem apiculatum, versus hilum appensa, hinc per sinum ventralem *raphide* loriformi percursa, crasso-membranacea: integumentum internum (*tegmen*) membranaceum, subadhærente, *chalaza* majuscula ventrali notatum. *Embryo* in *albumen* carnosum copiosum 3-plo longius summo versus faciem dorsalem excentrice reconditus, *radicula* summo attingens et hilo proxima, tereti, *cotyledonibus* vix latioribus acutis dorso parallelis chalaza remotis 3-plo longiori.

Arbores vel arbusculæ Brasilienses et Antillanæ *virescentes, ramosissimæ;* folia *ovata vel oblonga, coriacea, nitentia, pellucido-punctata, breviter petiolata, vernatione involutiva.* Inflorescentia *axillaris, racemosa, pauciflora, petiolo parum longior,* floribus 3 *ad* 6 *pedicellatis,* pedicellis *alternis, imo bractea obtusa adpressa donatis.*

1. *Cinnamodendron axillare,* Endl. Canella axillaris, *Nees et Mart. Nov. Act. Acad. Cæs.* xii. 18. tab. 3;—arboreum, cortice glabro, albicante, transversim crebre rimoso et calloso; foliis alternis, ovato-ellipticis, obtusiusculis, glabris, margine integro crenulatim undulato revoluto, supra nitidis, subtus pallidioribus, reticulato-venosis, crassis, coriaceis, petiolo brevi inferne carinato; racemis axillaribus petiolum paullo superantibus, sæpius 3-floris, floribus parvis, pedicellis puberulis, calyce æquilongis, imo 2-bracteatis, petalis exterioribus carnosis, interioribus tenuioribus fere æqualibus, pellucido-punctatis, stylo paullo exserto, truncato.—Brasilia, ad San Pedro dos Indios, circa Cabo Frio, in Prov. Rio de Janeiro.—*v. s. in hb. Hooker* (Martius)*.

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* A representation of this plant will be seen in plate 24 A.

This is described as a middle-sized tree: its leaves are from $1\frac{3}{4}$ to 2 inches long, and 14 to 15 lines broad, on a petiole 3 lines long: the racemes are few-flowered, and scarcely measure more than 4 lines in length: the flowers, when ripe, are only one-third the size of those of *Canella alba*; in the specimen above referred to they are in bud, but sufficiently advanced to make out the several parts. I found the inner row of petals glabrous, not ciliated, as described in the 'Nova Acta,' and equal in size to the outer row, not minute and squamiform; the anther-cells also are linear, not ovate, in which respects they agree with the following species. The tree is called by the natives '*Hierba moeira do Sertão*,' as mentioned in Spix and Martius's Travels (Reise, i. p. 83, ii. p. 336).

2. *Cinnamodendron corticosum*, n. sp.;—arboreum, biorgyale, ramosum, ramulis tenuiculis, flexuosis, lenticellis maculatis; foliis elongato-oblongis, utrinque acutiusculis, apice attenuatis, glaberrimis, integris, tenuiter anastomoso-nervosis et valde reticulatis, supra nitidis, subtus pallidioribus, et glanduloso-punctulatis, punctis porosis et minutissime pellucidis, margine revoluto, rachi petioloque brevi superne canaliculatis, infra carinatis; racemulis axillaribus, brevibus, 3–4-floris, petiolo paullo longioribus, pedicellis striatis, puberulis, flore præcedentis 2-plo aut 3-plo majori; ovario 1-loculari, ovulis numerosissimis in placentis carnosis prominentibus 5 (rarius 4), biscriatim affixis: stylo tubo æquilongo, stigmatibus 5 (rarius 4): bacca ovata, polysperma.—Ins. Jamaica apud Bath.—*v. s. in hb. Cl. Dom. Hanbury**.

This is a very distinct species, differing from the preceding in the form and size of its leaves. I am greatly indebted to Daniel Hanbury, Esq., F.L.S., who placed his specimens in my hands for examination, and who afterwards kindly sent to Jamaica for samples of the flower and fruit preserved in alcohol, from which I have been enabled to complete the above details. Its bark has the same aromatic properties as that of *Canella alba*, from which it is scarcely distinguishable, both being collected and exported under the same name. Its leaves are 5–6 inches long, $1\frac{1}{2}$–$1\frac{3}{4}$ inch broad, the petiole being 3–4 lines in length; the raceme is only 4–6 lines long; the berry is 6 lines in length, and 5 lines in diameter, containing about 10 seeds, which are much smaller than those of *Canella*, more reniform, much compressed, very rugose, and 1 line in length.

From the foregoing details of the structure of the flowers and seed of the *Canellaceæ,* we may with some confidence venture to assign the place which this small group should occupy in the system. Its structure is so palpably opposed to that of the *Clusiaceæ* (where *Canella* has generally been arranged by botanists), that it is quite unnecessary to enter into any discussion upon the value of such an affinity. This incompatibility was long ago shown by Prof. Lindley*, as before stated, upon very substantial grounds; he also proved that it could not be associated with *Platonia,* and that Gaertner was incorrect in his description of the fruit of *Canella.* In this uncertainty, he looked to the *Pittosporaceæ* as a more probable affinity. There are certainly several points of similitude between them, but the relationship appears to me very distant: the symmetrical number of the parts in the *Pittosporaceæ,* their petals united at the base into a short tube, their perfectly free stamens with introrse anthers opening by pores in the apex, the deep inflexion and union of the carpels in the centre, where they are placentiferous,—all combine to prove that these two families are far from being akin.

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* Analytical details and a drawing of this species are given in plate 24 B.

On the other hand, there exists, as I have already shown, a singular degree of accordance in the general habit of the *Canellaceæ* with *Drimys*: the same aromatic principle pervades their bark, leaves, and flowers; they have both similar alternate exstipulate leaves, furnished with transparent dots, and they have unsymmetrical biserial petals, with an imbricated æstivation. There is also a no less striking analogy between *Cinnamodendron* and *Drimys,* as well as *Illicium,* their ovary being unilocular, with longitudinal parietal placentation; and there is a remarkable parallel in the form and structure of the seed. There can therefore be no doubt that a very close affinity exists between these two groups. The *Canellaceæ,* however, will be found to differ from the *Winteraceæ* in their monadelphous stamens, and more particularly in their single ovary. In regard to their relative position in the system, if we follow the basis of the Jussieuan method, adopted by DeCandolle and most botanists, and carried out by Endlicher in his 'Genera Plantarum,' we cannot fail to arrive at this conclusion, that the several distinct ovaries, each formed of a single carpel united by its margins without any inflexion, which margins being on the ventral side and ovuligerous, form there a longitudinal parietal placentation, —characters that belong to the *Winteraceæ,*—unquestionably place that family in the class *Polycarpicæ.* On the other hand, we find in the *Canellaceæ* similar carpels; but instead of being distinct, they are united into one compound ovary by the simple junction of their placentiferous margins, thus forming a unilocular ovarium with compound parietal placentation: this Order

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* Veg. Kingd. 442.

Miers, J. On the Winteraceae. Contrib. Bot. 1: 123 - 145. pl. 25 - 27. 1861.

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must therefore come within the limit of the *Rhœades* of Endlicher, where we find the carpels similarly constituted. Notwithstanding this separation into different classes, it is evident, from the extremely close affinity existing between the two families, that they ought to be in juxtaposition in any linear arrangement; but I will again refer to this subject when I come to discuss the affinities of the *Winteraceæ*.

ON THE WINTERACEÆ.

THE only two genera belonging to this small group that were known in the time of Jussieu, were placed by that celebrated botanist, in his 'Genera Plantarum,' among the *Magnoliaceæ*,—an association which has been confirmed by most botanists since that time. DeCandolle, in his Syst. Veg. i. p. 548, first announced the opinion of Mr. Robert Brown (in 1818), that *Illicium* and *Drimys*, together with *Tasmannia*, should be classed in a separate family under the name of *Wintereæ*,—a suggestion only partially adopted by the former botanist in his 'Prodromus' (1824), when he formed them into a tribe of the *Magnoliaceæ*, under the designation of the *Illicieæ*, a classification that has since been generally adopted. Dr. Lindley, however, in his 'Nixus' (1833), and in his 'Introduction to Botany' (1836), is 34 the only one who appears to have carried out the suggestion of Mr. Brown in establishing this as a distinct family under the title of the *Winteraceæ*; but he subsequently abandoned this arrangement (in 1836), in his 'Vegetable Kingdom' (p. 417). M. Spach (in 1839), in the 'Suites à Buffon' (vii. 432), classed the *Wintereæ* as a tribe of *Magnoliaceæ*, evidently with much doubt, as he stated distinctly that he considered that group more allied to the *Dilleniaceæ* than to *Magnoliaceæ* (*l. c.* p. 432). Endlicher (in 1838), after the example of Spach, classed the *Illicieæ*, in his 'Genera Plantarum,' as a tribe of the *Magnoliaceæ*, but expressed his opinion that they ought rather to rank as a distinct order, between that family and the *Dilleniaceæ* (Enchir. p. 428). Lastly (in 1855), we have the authority of the authors of the 'Flora Indica' (p. 72), who give it as their opinion that the *Wintereæ* form a very questionable tribe of the *Magnoliaceæ*, and may with reason be separated from them, as soon as the systematic characters of other collateral groups are better established. Having already partially stated my own opinion on this subject (p. 122), when treating on the *Canellaceæ*, I will now proceed to mention the facts on which that conclusion is founded.

Although the *Winteraceæ* have unquestionably a considerable degree of affinity with the *Magnoliaceæ,* they are distinguished from them by several peculiar features: the latter are invariably signalized by very conspicuous and large vaginiform stipules, which fall off and leave a prominent annular cicatrice, like an articulation, round each node. In the *Winteraceæ* these stipules are entirely wanting. The wood, in the latter family, as well as in the *Canellaceæ,* and sometimes in the *Schizandraceæ,* contains vessels marked, like those of the *Coniferæ,* with very distinct dots, which are not visible in the *Magnoliaceæ.* The bark, as also the foliage of the *Winteraceæ* and *Canellaceæ,* abounds in an aromatic principle, and the younger leaves exhibit many pellucid dots, which are less visible in an older state, on account of the greater thickness and opacity of the parenchyma: this character is wanting in the *Magnoliaceæ;* or, if sometimes present, these dots are exceedingly minute and faint. In the latter family the several parts of the flower spring from a broad and highly conical torus, whereas this is extremely small in the *Winteraceæ.* In the latter group the ovaries are generally few, and always in a single whorl, sometimes reduced to two in number, or even solitary; in *Magnoliaceæ,* on the contrary, they are constantly very numerous, being arranged imbricately in many series upon a conical or almost cylindrical torus. The structure of the fruit in this last-mentioned family affords a very characteristic feature, generally consisting of a large cone or ball of many-seried aggregated capsules, more or less free, but sometimes forming a solid syncarpium; these capsules generally open by two valves, each exhibiting one or two tolerably large seeds (covered by a brilliant scarlet fleshy tunic), which fall out and remain suspended each by a long elastic thread: in the *Winteraceæ* the fruit is small, consisting of a few radiating carpels generally distinct; in *Illicium,* somewhat two-valvular; but in *Drimys* and *Tasmannia,* baccate, enclosing a few small, shining, black, cochleate seeds, of a structure different from those of *Magnoliaceæ,* and remarkably similar to those of the *Canellaceæ*: the hard crustaceous tunic, hitherto mistaken for the testa, so conspicuous in the latter family and the *Winteraceæ,* presents a striking contrast to the scarlet soft tunic, suspended by a long thread, in the *Magnoliaceæ*: in the latter order the raphe is found in this external fleshy coating, while the tunic beneath it is thick, hard, and bony; but in the *Winteraceæ* and *Canellaceæ* the outer coating is hard, brittle, and void of vessels of any kind; the raphe is seen in the second tunic, which is thick, soft and spongy (analogous to the outer tunic of *Magnolia*), while the coating next beneath it is thin and membranaceous. The embryo, in the former order, is situated in the axis of the albumen, at the extremity farthest removed from the hilum, and beneath the apical chalaza: in the two last-mentioned families, the embryo is excentrically placed near the rostrated summit of the albumen, at no great distance from the hilum, and at a more considerable interval from the lateral chalaza. There can be little doubt, therefore, that the *Winteraceæ* have far less affinity with the *Magnoliaceæ* than they have with the *Canellaceæ*; and it appears to me that the reasons here given fully justify their removal from the station hitherto assigned to them, and their approximation to the last-mentioned family, in the manner I now proceed to indicate.

The circumstances that seem to connect the *Winteraceæ* with the *Schizandraceæ* should not be lost sight of in this investigation. There are certainly many points of affinity between them; but some incompatible features are seen in the monœcious character of the latter order, and the trimerous arrangement of the parts: we must, however, remember that in *Tasmannia* there is an approximation in this respect; for if its flowers be not monœcious, they are often polygamous; and although *Drimys* generally does not agree with *Kadsura* and *Sphærostemma* in its parts being always in threes or multiples of three, we find these numbers in *Illicium*, and sometimes in *Drimys*; while, on the other hand, *Schizandra* differs from its congeners in having a pentamerous disposition. There is also in the *Winteraceæ* a tendency towards the *Schizandraceæ*; for though *Tasmannia* has only one or two, or sometimes four ovaries, and *Drimys* six to eight, *Illicium* has at times as many as eighteen distinct carpels,—but then, it must be remembered, they are always uniserial. There is also much similarity in the structure of their ovaries, that is to say, they are unilocular, with few ovules attached parietally to the ventral suture. The fruit in both orders is baccate and few-seeded, the seeds being reniform, somewhat small, with a crustaceous shining external tunic, and a short internal raphe along the sinus, together with an extremely small embryo imbedded at the extremity of the albumen near the hilum, having very minute cotyledons in proportion to the radicle. The *Schizandraceæ*, like the *Winteraceæ*, have alternate exstipulate leaves, which are equally distinguished by numerous pellucid dots; and I have before alluded to the peculiar dotted vessels contained in the wood of all these three families. In *Schizandra*, the stamens are united into a dilated tube or disk, and *Canella* offers some analogy with this; but the principal line of distinction that marks the group of the *Schizandraceæ* lies in its monœcious flowers, and in the multiserial disposition of its distinct and numerous carpels. Notwithstanding the well-marked characters that tend to separate these orders, enough has been shown to prove their near affinity.

The *Schizandraceæ* by some botanists are held to be merely a tribe of the *Magnoliaceæ*; but I have pointed out many of the characters that keep them distinct from the latter, and that place them in contiguity with the *Winteraceæ*. It is not possible, in any linear arrangement, to form so perfect an approximation of genera as by the circular system; but the nearest conformity is obtained by interposing the *Menispermaceæ* and *Lardizabalaceæ* between the *Anonaceæ* and *Magnoliaceæ*, and by the intervention of *Schizandraceæ* between the last-mentioned family and the *Winteraceæ* and *Canellaceæ*; by this disposition we form a chain of regular gradation, the links of which sufficiently harmonize together. Keeping thus the *Winteraceæ* in the relation best adapted to them, after all the other families of the *Polycarpicæ*, and placing the *Canellaceæ* at the head of the *Rhœades*, to which class, from their carpellary structure, they must belong, we thus maintain uniformity in the systematic arrangement, without disturbing the chain of linear gradation that naturally exists between these families.

The genera of the *Winteraceæ* have a wide geographical range. *Drimys* is distributed over all equinoctial South America, Mexico, the more temperate regions of Chile, the Strait of Magellan, and New Zealand. *Tasmannia* is met with in Australasia and Borneo, while *Illicium* is found in tropical Asia, Japan, and North America; and the coincidence may be remarked, that the *Schizandraceæ* exist only in the last-mentioned three distant regions. *Canella* has hitherto been met with only in the Antilles and the northernmost point of the South American continent, while *Cinnamodendron* is found on the very margin of the southern tropic of Brazil, as well as in the West Indies. The *Magnoliaceæ* are natives of many parts of India, of tropical South America, and the United States; and I believe there is no instance of the occurrence of any of the above-mentioned families in the continents of Europe and Africa. The *Lardizabalaceæ*, however, are found in the tropical parts of Africa and Asia, and also in extratropical South America; while the *Menispermaceæ* have a general cosmopolitan distribution.

I will now proceed to offer a few remarks upon the several genera of the *Winteraceæ*, and give an amended character of each, as far as my own observations extend.

1. Drimys.

This genus has been described by several botanists, more particularly by St. Hilaire, who enters into many details of its structure*. One of its peculiar features is in its calyx, which,

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* Pl. Usuelles, 5. pl. 26–28.

in the bud, forms one entire valveless covering, and at length bursts into two concave segments, more by a laceration of the tegument than by any distinguishable commissure: it is deciduous. Its lanceolate petals are distinct to the base, and are variable in number, being sometimes only five to eight, when they are uniserial; in other cases they vary from ten to sixteen, when they are biserial; and not unfrequently they are as many as twenty-four, when they are in three whorls: they are white, and also deciduous. The stamens likewise vary in number, being generally very numerous, and arranged in one to seven whorls, of five to eight in each whorl, somewhat increasing in length, the inner series being longest: they are all short, less than one-sixth the length of the petals, and seated, together with them and the ovaries, upon a very short stipitiform gynobase. The ovaries, which are variable in number, from five to eight, are always free, uniserial, and erect; they have no sensible style, the short umbilicated stigma being sessile upon the ventral side of the conical and somewhat gibbous ovary, just below its apex, from which point a ridge extends to the base: they are always unilocular, with a single placentiferous line upon the ventral face, corresponding with the ridge just mentioned. Upon the edges of this band are arranged about sixteen ovules, in eight collateral series, extending from the stigma to the base of the cell, each reniform ovule being suspended from its sinus by a short funicle. The ovaries ripen into as many small pear-shaped berries, each containing ten or fewer seeds, closely packed in a thin pulp, which possesses a very aromatic taste and smell. The seeds are densely black, very polished, obtusely rostellated above, swelling below in a somewhat reniform or cochleate shape, with a small concave hilum beneath the summit, to which the short funicle is attached. The outer shell is thin, hard, and brittle, formed entirely of short, transverse, crystalline cylinders, without vessels of any kind : the next tunic beneath this brittle shell is of a spongy texture, and of cellular structure, the cells being filled with coloured aromatic oily matter; it is covered by a thin pellicular reticulated membrane, inside of which, and adhering intimately to it upon its ventral side, there is seen a very distinct thick cord of some length (a raphe), consisting of a bundle enclosing spiral vessels, which cord extends from the hilar point to a dark spot (the chalaza) situated just below the deep sinus: again, within this coating, there are two very distinct reticulated membranes, which, by the medium of a small quantity of intervening glandular matter, become somewhat adherent together; these integuments are homogeneous in all parts, except where they are thickened at the chalazal disk just mentioned. The enclosed nucleus consists of a mass of fleshy albumen, within which, close to the hilum, is found a very minute embryo, of a short cylindrical form, rounded obtusely at each end, that directed towards the centre of the albumen having a very short but distinct cleft, indicating two minute cotyledons. St. Hilaire states that this embryo is entire, and that, after careful examination, he could not detect in it any trace of cotyledons*. I have invariably found, on the contrary, in the seeds of *Drimys Chilensis*, the very distinct cleft above mentioned. St. Hilaire also describes the radicle as protruding beyond the albumen : I have not found this to be the case; although there is an appearance of such an occurrence, when the thin portion of the albumen that covers its extremity breaks away by its adherence to the inner integument, if the latter be not very carefully removed. The embryo is surrounded by a small quantity of glutinous juice, and from the cotyledonary cleft is seen a narrow tubular membrane, longer than the whole embryo, extending along the axis of the albumen, and which, no doubt, is the remnant of the embryo-sac.

We can have little hesitation in referring to their proper denomination the different seminal tunics above described. On a former occasion† I have entered into a lengthened discussion upon the structure of the several coatings of seeds in general, and have shown that their nature can always be determined with certainty by the position of the raphe in regard to them; it has been demonstrated that any integument exterior to that which bears the raphe must be of a growth subsequent to the fertilization of the ovule, and therefore extraneous to, and distinct in its nature from those resulting from the growth of the proper tunics of the nucleus; and that such coating, be it membranaceous, thick, fleshy, coriaceous, horny, or osseous, must be arilliform in its origin. Judged by this rule, the black, hard, brittle shell of the seed of *Drimys*, hitherto considered as its testa, would be an arillus; and the spongy coating in which the raphe is imbedded is that condition which I have called an arilline‡, or growth of the primine into the state of a thick fleshy integument.

The genus *Drimys* consists of evergreen trees of moderate size, possessing a hard wood, the bark of which is extremely aromatic in smell and taste, whence the species peculiar to Chile bear there the name of Canelo, the bark of which is called Canela, the Spanish word for cinnamon. The leaves are alternate, generally glaucous beneath; the inflorescence, sometimes axillary, is usually terminal, often in aggregated one-flowered peduncles, and frequently these peduncles bear on their summit a number of one-flowered pedicels, aggregated in form of an umbel, with a row of involucrated bracts at their base. With the exception of one, peculiar to New Zealand, and another growing in the island of Juan Fernandez, the plants of this genus are restricted to the continent of South America, one only extending into the northern hemisphere. *D. Granatensis* appears in the mountainous districts of the western tropical portion of the continent; a few distinct forms inhabit Brazil, while others are extratropical, *D. Winteri* confining itself to the Patagonian extremity of Chile. Sir W. Hooker, many years ago*, seemed disposed to merge *D. Chilensis* into the Magellanic species, on account of the similarity of their leaves; and more recently, Dr. Hooker†, after examining the many species of *Drimys* collected in various parts of the whole American continent, gave his opinion that all of them, including the one from Mexico and that from the island of Juan Fernandez, are mere varieties of *D. Winteri*. To this opinion I cannot subscribe, for reasons I will here offer; nor can I agree with St. Hilaire, that the different Brazilian forms which he describes‡ are only varieties of *D. Granatensis*. There is certainly a great uniformity of general appearance among the individuals throughout the genus, for, in all, the leaves are quite smooth, thick, entire, oblong, polished, veinless, with an inferior glaucous or whitish surface; but there is a certain character among them, by which, without mistake, we may assign to each the country of its origin. There are, however, in each of these several groups so many modifications of form, as well in the leaves as in the inflorescence, that it is almost impossible to offer good specific characters for them. I think it better, therefore, to take the middle course, and regard such individuals as so many varieties, and to consider each group as a distinct species, for which a clear diagnosis may be established. Under this point of view, the species will consist of the New Zealand form, *D. axillaris*, the Magellanic tree, *D. Winteri*, the Chilian *D. Chilensis*, and that from the region of the Ecuador, *D. Granatensis*, in which I would include the Mexican variety; I would establish *D. Brasiliensis* for the different Brazilian forms enumerated by St. Hilaire, with the exception of *D. montana*; to these may be added two other distinct species, here proposed, from Southern Brazil; completing the list by *D. Fernandeziana*, from the island of Juan Fernandez.

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* *Loc. cit.* p. 7.

† Linn. Trans. xxii. p. 81.

‡ Linn. Trans. xxii. p. 89.

The younger Linnæus, who received specimens of *D. Granatensis* from Mutis, concluded it to be a variety of the Magellanic species§; but Lamarck first pointed out‖ the forcible distinction between them, and Bonpland subsequently confirmed this by farther observations*. These botanists showed that in *D. Winteri* the flowers are always solitary upon several simple peduncles, which are aggregated at the termination of the branchlets; while *D. Granatensis* is strongly characterized by each of these peduncles invariably bearing upon its summit three to five long umbellated pedicels, severally supporting a flower. *D. Chilensis* partakes of this latter character, and is therefore equally distinct from the Magellanic species. The general resemblance in the shape and size of the leaves in *D. Winteri* and *D. Granatensis* is certainly great; they have also the same dark green hue, with a more dealbated under surface, and a similar deep red midrib and petiole—so much so, that if the character of the inflorescence were put aside, they might be considered varieties of the same species: the inflorescence, however, constitutes a good specific difference, which is constant in each. Between *D. Granatensis* and *D. Brasiliensis* there is not only a dissimilarity in the appearance of the leaves, which in the former are more narrowly cuneated at the base, and of a much darker hue, but the inflorescence is distinguished in the former by its very long peduncles, its more lengthened and fewer pedicels, its larger flowers with a greater number of petals, and, finally, the inflorescence is axillary as well as terminal, which gives it a prominent character. *D. Chilensis* is subject to as many varieties in the size of its leaves, and the greater or less abundance of its inflorescence, as *D. Brasiliensis*; but there is a perceptible difference in the size and number of the pellucid dots which correspond with the raised glands upon their upper surface: in *D. Brasiliensis* and all its varieties they are comparatively larger and more distant; the leaves are far more coriaceous and opake, so that in most instances the raised glands cease to be pellucid; and sometimes are wholly immersed: in *D. Chilensis* and in *D. Winteri* the punctate dots are much smaller, and more densely approximate. It is always easy to distinguish, at a glance, the difference between the two last-mentioned species: in the latter the branches are angular, invariably of a dark red colour, that gives it a peculiar character; the petiole is very much stouter, considerably shorter and broader, rugose, and darker coloured; the nervures of the leaves are fewer, and are soon lost by entire immersion in its much thicker parenchyma; while in *D. Chilensis* the petiole is longer, proportionately narrower, the nervures are closer, at least double in number, more conspicuous, and arcuately conjoined long before they reach the margin. I have already mentioned that in *D. Winteri* the inflorescence constantly consists of a few terminal simple peduncles, each bearing a solitary flower; but in *D. Chilensis* the peduncles are as numerous, are longer, broadly compressed, and always bear on their summit six or seven umbellated pedicels, each supporting a flower, and these are surrounded at their base by a verticil of deciduous bracteoles; where there are seven pedicels, this involucre consists of six bracteoles; and with six pedicels it has five bracteoles. In *D. Granatensis* this umbel is formed of only three to five pedicellated flowers, and the bracteoles are far more deciduous. In *D. Winteri* the calyx is larger, and the petals shorter and broader in proportion, seldom exceeding six in number; while in *D. Chilensis* I have always found ten petals: the former has usually four ovaries, the latter generally five. These differences, added to their general aspect, and their distinct geographical distribution, appear to me sufficient to establish the validity of these several species nearly as they are described by DeCandolle and other botanists.

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* Bot. Misc. iii. 134.

† Flor. Antarct. ii. 229.

‡ Pl. Usuelles, tab. 26, 27, 28.

§ Linn. fil. Suppl. 269.

‖ Dict. Encyc. Méth. ii. 330.

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* Pl. Æquin. i. 208.

The plant from Juan Fernandez I consider to be specifically distinct; and I find another, from extratropical Brazil, with smaller and very narrow, almost linear leaves, and terminal flowers on simple peduncles, which is certainly different from *D. Brasiliensis*; and likewise a third, of remarkable aspect, collected by Claussen in the province of Minas Geraës, to which Dr. Hooker* alludes, as being a singular state of *D. Granatensis*; but it ill-accords with that species, on account of its inflorescence, and its smaller and excessively revolute leaves. I have referred to *Tasmannia*, for reasons that will be given, the species from the island of Borneo, *D. piperita*, placed in this genus by Dr. Hooker.

I may here remark, that some of the species (more especially *D. Granatensis*) have a disposition to produce what gardeners call double flowers; in the variety *Mexicana* of that species there are usually twelve petals, which are sometimes increased to twenty-four in number†.

The anthers in *Drimys* are generally described as being dorsally attached to the broad filament, but this is not the case; the two cells are quite separate, and affixed by a median line to the margins of the filament, which margins are reflected outward, so that the anther-cells are thus approximated, and thrown into an extrorse position. In farther proof of this, I may here mention that I have sometimes met with a stamen half-transformed into a petal, in which case the anther-cells are widely separated, and attached to each margin of the petal, a little below the middle.

I propose dividing the species into four sections, distinguished by the simple or umbellate, either terminal or axillary flowers,

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* Flor. Antarct. ii. 230.

† DeC. Syst. i. 444.

and suggest the following emended character from my own observations.

Drimys, Forst. Wintera, *Murr.*—*Flores* hermaphroditi. *Calyx* in alabastro clausus et indivisus, demum lacerato-partitus in segmentis 2–3 concavis, reflexis, deciduis. *Petala* 6 ad 24, oblonga vel lineari-lanceolata, 1–3-seriata, calyce 3–4-plo longiora, toro subcylindrico cum staminibus insita, patentia, decidua, æstivatione apicibus replicatis imbricata. *Stamina* plurima (15 ad 40), indefinita, pluriseriata, hypogyna, brevissima; *filamenta* compressa, crassiuscula: *antheræ* 2-lobæ, lobis ovatis, sejunctis, subdivaricatis, ad margines versus apicem filamenti utrinque affixis, vix extrorsis, linea longitudinali 2-valvatim dehiscentibus. *Ovaria* 5–8, distincta, summo tori uniseriatim affixa, ovata, gibba, unilocularia: *ovula* plurima, reniformia, e placenta solitari parietali, ventrali, medio funicula brevi, biseriatim appensa. *Stylus* subnullus. *Stigma* parvum, breve, pulvinatum, umbilicatum, infra apicem latere ventrali situm. *Baccæ* 4–8, distinctæ, oblongæ, gibbæ, carnosæ, summo tori elevati sessiles, 1-loculares. *Semina* in quaque 3–10, cochleato-reniformia, hilo apicali punctiformi horizoutaliter suspensa: *tunica externa* (arillus) dura, crystallino-crustacea, subfragilis, nitida, atra, nucleum valde gibbum et crasso-virgulæformem claudeus: *tunica intermedia* (arillina) crassiuscula, celluloso-spongiosa (*raphide* conspicuo chordiformi sigmoideo ab apice usque ad chalazam percursa), et ad *integumentum tertium* membranaceum adhærens; *chalaza* lateralis versus sinum spectans: *integumentum quartum* membranaceum, reticulatum. *Embryo* in verticem albuminis carnosi copiosi miuutissimus, breviter cylindricus, utrinque obtusus, *cotyledonibus* brevissimis, *radicula* hilo proxima, supera.

Arbores sempervirentes *in America, a Mexico usque ad Fretum Magellanicum et in insulis Mari Pacifici crescentes,* cortice *aromatico;* folia *exstipulata, alterna, integerrima, coriacea, glaberrima, subtus sæpius glauca, pellucido-punctata, petiolata;* flores *pedunculati, aggregati, e gemma acuminata foliolis convolutis cito deciduis orti, sæpius terminales, rarius axillares, pedunculis aut unifloris, aut apice pedicellis plurimis umbellatis floriferis imo bracteolatis gerentibus, bracteolis involucratis parvis caducissimis.*

Div. 1. *Pedunculi plurimi, aggregati, axillares, 1-flori.*

1. *Drimys axillaris,* Forst. Gen. 84. tab. 42; DC. Syst. i. 443; Prodr. i. 78; Hook. Icon. 576; Hook. fil. Fl. Nov. Zeland. i. 12. D. colorata, *Raoul, Pl. Nouv. Zél.* 24. pl. 23.—Nova Zelandia.

This is admitted on all hands to be a good species, concerning

which there is nothing calling for remark, except that I accord with Dr. Hooker in considering Raoul's plant as specifically identical with it.

Div. 2. *Pedunculi axillares, umbelliferi, pedicellos* 3, *rarius* 7, *bracteolatos* 1-*floros gerentes.*

2. *Drimys Granatensis,* Mutis, Linn. fil. Suppl. 269; DC. Syst. i. 444; Prodr. i. 78; H.B.K. v. 53. D. Mexicana, *Moç. et Sess. DC. Syst.* i. 444; *Prodr.* i. 78. Vintera Granatensis, *Bonpl. Pl. Æquin.* i. 205. tab. 58;—foliis oblongo-lanceolatis, imo cuneato-angustioribus, summo subacuminatis, coriaceis, opacis, marginibus nitidis revolutis, superne lucidis, fusco-viridibus, inferne granuloso-incanis, granulis creberrimis porosis, nervis pluribus tenuibus sese arcuatis vix distinguendis, costa media rubella paullo prominenti, petiolo longiusculo semitereti, angusto, canaliculato; floribus axillaribus, e pedunculo sæpissime folii fere longitudine, ancipiti, pedicellis 3–5 longissimis, umbellatis; petalis 10–12; staminibus 30–40; ovariis 10–12. — In Nova Grenada, Columbia et Mexico.—*v. s. in herb. Mus. Brit.* Santa Fe di Bogota (Mutis), (Dombey); *in hb. Hook.* Bogota (Turner et aliis), Columbia, Mexico (Hartweg, 444).

Folia 3-$4\frac{1}{2}$ poll. longa, 9–21 lin. lata; petiolus 5–9 lin. longus; pedunculus sæpius 2–3 poll. longus; umbella rarius foliifera; pedicelli sæpius 3, graciliores, compresso-trigoni, 1–$1\frac{1}{2}$ poll. longi. Calyx in alabastro globosus, ruptiliter 2-partitus; petala sæpius 12, biseriata; stamina crebra, brevissima, 3-serialia, gynophoro inserta; ovaria sæpius 12*.

A specimen in the British Museum, collected by Dombey in Santa Fé (de Bogota?), though only fragmentary, exhibits a more than ordinary amount of development: it consists of two loose leaves and one loose umbel; the leaves are 5–$5\frac{1}{2}$ inches long, 2 inches broad, on a petiole 8–9 lines long; the peduncle is compressed, a line broad, and $3\frac{1}{2}$ inches long, bearing on its summit two leaflets and five pedicels; the leaflets are obtusely obovate, cuneate, $1\frac{3}{4}$ inch long, including a petiole of 1 line, and the pedicels are $1\frac{3}{4}$–2 inches long; the flowers expanded are nearly $1\frac{1}{4}$ inch in diameter, the petals being 6 lines long, 4 lines broad, and rounded at their summit. The total inflorescence is nearly 7 inches in length, or 1 inch longer than its unusually large leaves.

3. *Drimys montana.* D. Granatensis var. montana, *St. Hil. Pl. Us.* 3. tab. 28;—ramis teretibus, foliis congestis, cuneato-

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* A drawing of this species is given in plate 27 A.

oblongis, apice obtusis et sæpe subemarginatis; marginibus crassis valde revolutis, coriaceis, supra lucidis, nervis parallelis omnino immersis, subtus pruinoso-albidis, nervis vix distinguendis, costa media rubella valde prominenti, petiolo longiusculo canaliculato; inflorescentia axillari et terminali; pedunculis subtenuibus, compressis, folii fere longitudine, simplicibus vel interdum 2–3-fidis, et tunc pedicellis illis brevioribus.—Brasilia; Serra Negra in Prov. San Paolo (St. Hilaire).—*v. s. in hb. Hook.* (Claussen) ex Minas Geraës.

Folia $1\frac{1}{2}$–$2\frac{1}{2}$ poll. longa, 6–9 lin. lata, petiolus 4 lin. longus; pedunculus $1\frac{1}{4}$–$1\frac{1}{2}$ poll. longus; pedicelli 6–10 lin. longi; petala 10–15, linearia, acuta, 3 lin. longa, 1 lin. lata; stamina circiter 40, 3-serialia; ovaria 6; baccæ 3, gibboso-oblongæ, 2–3 lin. longæ.

This I consider to be a distinct species, evidently allied to the following, and it differs from *D. Brasiliensis,* not only in the size and form of its leaves, but in its axillary inflorescence, and in the number of the parts of its smaller flowers.

4. *Drimys retorta,* n. sp.;—ramis teretibus, junioribus subangulatis, transversim rugulosis; foliis lanceolato-oblongis, apice obtusis et valde emarginatis, imo cuneatis, marginibus subito spiraliter revolutis, paginam inferiorem hinc fere celantibus, crasso-coriaceis, enerviis, superne nitidis, viridibus, in costam sulcatis, subtus subochraceo-pruinosis, costa media prominula, petiolo sulcato, marginibus involutis; inflorescentia axillari, umbellata; pedunculo brevissimo, crassiusculo, aut sæpe obsoleto; pedicellis 3–6, elongatis, gracillimis, sub-3-gonis, folio subæquilongis, erectis; petala 10; stamina 30; ovaria 5, quorum sæpius 2 abortiva.—Brasilia, in Prov. San Paolo (Bowie); Prov. Minas Geraës (Claussen)*.

Folia 1–$1\frac{1}{2}$ poll. longa, limbo utrinque convoluto 2–$2\frac{1}{2}$ lin. diametro, maceratione expansa 4–$5\frac{1}{2}$ lin. lata; petiolus 4 lin. longus; pedunculus in axillis $\frac{1}{2}$ lin. longus; pedicelli fere filiformes, $1\frac{1}{4}$ poll. longi; calyx clausus, oblongus, apiculatus, $1\frac{1}{2}$ lin. diametro, ruptiliter sub-2-valvis, segmentis concavis, 2 lin. longus, demum delapsus, et tunc pertusus circa pedicellum trajectus; petala 8–10, linearia, 2-seriata, $2\frac{1}{2}$ lin. longa, 1 lin. lata, mox decidua; stamina circiter 30, brevissima, 3-serialia; baccæ 3, gynophoro cylindrico insitæ.

This is evidently allied to the former species: *D. montana,* however, is readily distinguished by its leaves, which are but little revolute on their margins, and are almost obsoletely emarginated in the summit; it has very lengthened peduncles, which

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* A figure of this plant is shown in plate 2~~5~~6 B.

are even longer than its somewhat stout pedicels, and it differs also in the greater number of its petals (12 to 15).

Div. 3. *Pedunculi plurimi, aggregati, terminales,* 1-*flori.*

5. *Drimys Winteri,* Forst. Gen. 84. tab. 42; Lam. Dict. ii. 331; DC. Syst. i. 443, Prodr. i. 78; Hook. Fl. Ant. ii. 229. D. punctata, Lam. Dict. ii. 330, Illust. tab. 494. fig. 1. D. aromatica, *Desc. Ant.* i. pl. 40. Winterana aromatica, *Sol.* Wintera aromatica, *Murr. Syst.* 507; *Willd. Sp.* ii. 1239; *Bonpl. Pl. Æquin.* i. 209;—ramulis subangulatis, fuscorubris; foliis oblongis, utrinque attenuatis, apice obtusiusculis, supra nitidis, enerviis, aut nervis vix distinguendis omnino immersis, subtus glaucis, costa mediana margineque cartilagineo revoluto rubris, petiolo crasso, semitereti, longiusculo, superne subsulcato; pedunculis terminalibus, simplicibus, confertis, elongatis, angulato-sulcatis, apice compressis, imo bracteis deciduis involucratis; calyce majori; petalis 5–6, oblongis; ovariis 4, rarius plura.—In Patagonia et Tierra del Fuego.

Folia subtus e punctulis granulosis albis creberrimis glauca, 3–3¾ poll. longa, 12–16 lin. lata; petiolus 6–10 lin. longus, crassus, imo amplior; pedunculus 1–1½ poll. longus; alabastrus 3–4 lin. diam.; petala 6 lin. longa*.

I may here observe, that Lamarck's drawing of this plant is defective, and that Sir Wm. Hooker's figure, described under the name of *D. Winteri* (Bot. Mag. 4800), must be referred to *D. Chilensis,* which I consider specifically distinct, for reasons already given.

6. *Drimys angustifolia,* n. sp.;—foliis elongato- vel lineari-lanceolatis, apice obtusiusculis, planis, marginibus recurvulis, opacis, superne haud rugulosis, nervis omnino immersis vix distinguendis, subtus pallide glaucis, petiolo marginibus tenuibus sese involutis hinc subtereti; inflorescentia terminali pauciflora, pedunculis simplicibus. — In Brasilia Australi: *v. s. in hb. Hook.* (Sello).

Folia subtus e punctulis granulosis ochraceo-albis creberrimis glauca, 2 poll. longa, 2½–3 lin. lata, petiolus 4–5 lin. longus; pedunculus 6 lin. longus, subvalidus; calyx in alabastro clausus, integer, ovatus, apiculatus, demum 2-partitus; petala 9, linearia, in æstivatione imbricatim inflexa; stamina 18; ovaria 5†.

This is another and still more extreme form than *D. retorta,* with which it bears some analogy. I have observed a variety of the same (which may be called *lanceolata*) with broader and more oblong leaves, rather obtuse at the summit; the limb flat, 1½ inch long, 3–3½ lines broad, with a petiole of the length of 3 lines: it is of Sello's collection, and is probably from the same region as the above; but as the specimen has no flowers, it is impossible to give its characters and proper place.

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* A representation of this species is shown in plate 25 A.

† A figure of this plant is given in plate 26 A.

Div. 4. *Pedunculi plurimi, aggregati, terminales, pedicellos plurimos umbellatos 1-floros gerentes.*

7. *Drimys Chilensis,* D.C. Syst. i. 444, Prodr. i. 78; Deless. Icon. i. 22. tab. 83; Gay, Chile. D. Winteri, *Hook.* (non *Murr.*) *Bot. Mag.* tab. 4800;—ramulis teretibus; foliis oblongo-obovatis, versus apicem obtusum gradatim angustioribus, basi obtusiusculis et repente attenuatis, coriaceis, opacis, nervis plurimis, conspicuis, arcuato-nexis, et vix prominulis, supra crebre leviter granuloso-rugulosis, granulis sub lente puncto nigro signatis, punctis pellucidis, subtus e punctulis albis creberrimis glaucis, costa media prominente, margine cartilagineo recurvulo, petiolo valido subtereti canaliculato; pedunculis terminalibus 4–10, pedicellis 6–8 elongatis umbellatis e singulo ortis; petalis 10 linearibus; ovariis sæpius 5.—Chile.

Folia 3½–4½ poll. longa, 1–1½ poll. lata, petiolus 5–6 lin. longus; pedunculi in apice ramulorum aggregati, 3–9 lin. longi, crassiusculi, compressi; pedicelli tenues 9–14 lin. longi, 4-goni; calyx 2-sectilis, laciniis æqualibus, ovalibus, concavis, pallidis, 2 lin. longis. Petala 10, linearia, expansa, 2-serialia, 5 lin. longa, 1½ lin. lata. Stamina 35–40, exteriora breviora, interiora 1½ lin. longa, 4-serialia. Ovaria 5, rarius 6, gibba, 2 lin. longa. Baccæ 5, pyriformes, purpurascentes, 4–4½ lin. longæ; semina circiter 12, cochleata, nitidissima, atra, in pulpam parcam nidulantia*.

There is a variety (*latifolia*) with much broader leaves, tolerably well represented in Delessert's 'Icones' (i. tab. 83),—but the petioles are too broad and flattened, the flowers much too large, and the petals too flat,—a specimen of which I find in Sir Wm. Hooker's herbarium, collected by Bridges; the leaves are 5¼ inches long, 2½ inches broad, the petiole being 6 lines in length.

8. *Drimys Brasiliensis.* D. Granatensis in partem, *DC. Syst.* i. 444; *Prodr.* i. 78; *St. Hil. Pl. Us.* tab. 26, 27;—foliis oblongis, acutiusculis, aut obtusis, basi cuneatis, supra nitidis,

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* A figure of this species, with full generic details, is given in plate 26 c.

leviter granuloso-rugosis, granulis concoloribus, subtus (excepto margine revoluto et costa media prominenti) albido-glaucis, opacis, crasso-coriaceis, obsolete nervosis, petiolo longiusculo, canaliculato; inflorescentia terminali, pedunculis ancipitibus, longiusculis; pedicellis sæpius 3, rarius 5, umbellatis, compressis, longulis; petalis 12, oblongis, acutis; ovariis 5–7.—Brasilia*.

Folia 3–4½ poll. longa, 1–1½ poll. lata, petiolus 6–9 lin. longus; puncta pellucida quam in præcedenti majora et sparsiora; petala biserialia; stamina crebra circiter 40 brevia; gynophorus cylindricus longiusculus. Variat magnitudine foliorum et abundantia florum.

α. var. campestris, *St. Hil. loc. cit.* 1. tab. 26.
β. var. sylvatica, *St. Hil. loc. cit.* 3. tab. 27.
γ. var. axillaris, *St. Hil. loc. cit.* 3.

9. *Drimys Fernandezianus*, n. sp.;—foliis in apice ramulorum confertis, lanceolatis, utrinque paullo acutis, acumine obtusiusculo, superne nitidis, confertim granulosis, granulis porosis, subtus e punctulis albis crebris minutissimis incanis, nervis tenuibus utrinque immersis, vix prominulis, longe intra marginem sese arcuatis, costa media crassa, prominenti, rubescente, glabra, superne sulcata; petiolo brevissimo, lato, rubello, subamplexicauli; floribus terminalibus, umbellatis, pedunculis elongatis, plurimis, confertis, rubellis, valde ancipitibus; pedicellis 6, gracilibus, longiusculis; petalis 8; ovariis 8.—In Insula Juan Fernandez.—*v. s. in herb. Hook.* (Bertero, n. 1453; Cuming, n. 1328).

Folia 3–3¾ poll. longa, 6–11 lin. lata, petiolus 1½ lin. longus et latus; pedunculi terminales plurimi, conferti, 9–12 lin. longi, valde compressi, striati, pedicellis vix breviores, tenuiores; calyx 2-partitus, imo demum circa gynophorum circumscissus, et in pedicello trajecto delapsus; petala 8, linearia, pellucido-punctata; stamina 40 et ultra, in seriebus 4 disposita; antheræ subextrorsæ; ovaria 8†.

It is stated in the 'Flora Antarctica,' p. 229, that this plant quite conforms to that collected in the Organ Mountains of Rio de Janeiro by Gardner (his No. 5675); this latter plant was also found by myself in the same locality, and I made a drawing of it on the spot; but I do not perceive the same resemblance between them. There is a striking difference in the length of the petiole, which, in the Brazilian plant, is three or four times

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* A drawing of this species is shown in plate 25 B.

† A drawing of this species is given in plate 27 B.

the length, and only half the breadth of the other; it has much stouter peduncles, and pedicels of only half the length of the other, their number being only three in the Organ Mountains plant, and six or seven in that from Juan Fernandez; the former has twelve petals and six or seven ovaries; the latter usually eight petals and eight ovaries.

2. Tasmannia.

There appears to be little difference between this genus and *Drimys*, the principal distinction being in its sometimes polygamous or monœcious flowers, and in its having occasionally, by abortion, only one or two ovaries; there is, however, a marked difference in the form of its stigma. The calyx is at first entire, and closed as in *Drimys*, and becomes divided into two equal hemispherical valves, which soon fall away. Endlicher erroneously describes the calyx as consisting of two flat sepals. One species has eight or ten petals, a second five or six, while in the third their number is sometimes reduced to two. The stamens are seated upon a short cylindrical gynophorus, in four rows, of which the outer series are shortest; the oval anther-cells, separated by an interval, are adnately fixed and partly immersed in the margin of the filament, and they burst by a lateral fissure. The ovaries, sometimes solitary, often two or four, are seated in the centre of the stamens; they are suborbicular, somewhat gibbous, with a sessile stigma in the form of a crenated crest, which runs from the apex down the inner side; they are unilocular, with a single longitudinal parietal placenta, which in the male flower is often sterile, but which in the female bears several ovules arranged biserially as in *Drimys*. The fruit is a berry, about the size of a large pea, with a furrow upon two opposite sides; it contains from fifteen to eighteen small reniform seeds, with a polished black exterior, and which in general structure appear to correspond with those of *Drimys*.

The species hitherto assigned to this genus are natives of Australia and Van Diemen's Land, where they form evergreen trees, the bark and leaves of which generally abound in an aromatic principle, as in *Drimys*. I have no hesitation in referring hither the *Drimys piperita* of Dr. Hooker, from the island of Borneo, where it is found at an altitude of 8000 feet. It agrees with *Tasmannia* in its flowers sometimes having no stamens, with a solitary carpel; and we often meet with hermaphrodite flowers, sometimes having only one, but more generally having four ovaries. Its fringed stigma, decurrent to the bottom of the ovary, corresponds with *Tasmannia*, and is quite at variance with that of *Drimys*: in like manner, the form and position of

the anthers upon more elongated filaments differ from that genus.

The following is offered as an emendated character:—

Tasmannia, R. Br.—*Flores* monoici, polygami, aut hermaphroditi. *Calyx* in alabastro clausus et indivisus, ovato-globosus, summo apiculatus, demum lacerato-partitus in laciniis 2, rarius 3, concavis membranaceis parallele nervosis pellucido-punctatis reflexis, denique circumscissus, et deciduus. *Petala* 5–10, lineari-oblonga, 3-nervia, pellucido-punctata, expansa, 2-serialia, æstivatione parallela, apicibus quincuncialiter imbricatis. *Stamina* plurima, gynophoro subgloboso inserta, 4-seriata, quorum exteriora breviora, interiora gradatim longiora; *filamenta* longiuscula, loriformia; *antheræ* parvæ, 2-loculares, loculis oblongis, sejunctis, fere parallelis, margine filamenti utrinque subextrorsim adnatis, rima longitudinali dehiscentibus. *Pollen* globosum, obscurum, sulcis 3 signatum. *Ovaria* sæpe solitaria, aut interdum dua vel quatuor, staminibus 2–4-plo breviora et superposita, oblonga aut globosa, gibbosa, 1-locularia, in ♂ paullo minora et sterilia, in ♀ pluriovulata: *ovula* reniformia horizontalia in placentam parietalem longitudinalem ventralem biseriata. *Stylus* nullus. *Stigma* sessile, e summo introrsim decurrens, undulato-crenatum. *Bacca* solitaria (rarius plures), carnosa, globosa aut oblonga, 1-locularis. *Semina* plurima, reniformi-cochleata, angulata, apice affixa; *tunica externa* dura, nitida, atra, crystallino-crustacea, fragilis; *tunica intermedia* raphigera, bullata, carnosula; *raphe* immersa, simplex, e summo ad *chalazam* sinu proximam percurrens; *integumenta interiora* bina, tenuissime membranacea, distincta, sed ad chalazam crassiusculam inter se coalita. *Albumen* copiosum, cylindricum, in formam virgulæ curvatum, extremitate basali (chalaza tecta) hinc superne spectanti, apicali recta; *embryo* in verticem valde minutus cylindricus, *radicula* supera, *cotyledonibus* minutissimis centripetis.

Frutices *sempervirentes in Australasia, insulis Novæ Zelandiæ et Borneo indigeni, monticoli, glaberrimi, plerumque oleo aromatico repleti;* folia *sparsa, integerrima, pellucido-punctata, petiolata;* pedunculi *terminales aut axillares brevissimi aut obsoleti;* pedicelli *plurimi, umbellatim aggregati, graciles, folio multo breviores.*

1. *Tasmannia aromatica,* R. Br., DC. Syst. i. 445.; Prodr. i. 73; Del. Icon. i. tab. 84; Bot. Reg. 2 ser. xvii. tab. 43; Hook. Fl. Tasm. i. 11. Winterania lanceolata, *Poir. Dict. Méth.* viii. 799. —In Australasia et Insula Van Diemen.

2. *Tasmannia insipida*, R. Br., DC. Syst. i. 445; Prodr. i. 78; Bot. Reg. 2 ser. xvii. tab. 43. T. monticola, *A. Rich. Sert. Astrol.* 50. tab. 19.—In Australasia, Port Jackson.

3. *Tasmannia piperita.* Drimys piperita, *Hook. fil.*; *Hook. Icon.* 896;—arbuscula glaberrima; ramulis novellis, glaucis; foliis concoloribus, oblongo-lanceolatis, utrinque attenuatis, integerrimis, undique glaberrimis, valde reticulatim venosis, imo in petiolum canaliculatum anguste decurrentibus; pedicellis 2–3, unifloris, e pulvino axillari ortis, floribus monoico-polygamis; calyce 2-partito; petalis 8–10, lineari-oblongis, obtusis; stamina circiter 30, aut nulla; ovaria 1 ad 4.—Borneo; *v. s. in hb. Hook.*

I have already stated some of my reasons for referring this plant to *Tasmannia* rather than to *Drimys.* The latter genus has been found only in the western world and in the islands of Juan Fernandez and New Zealand, the plants of which latter country present so many curious analogies with the extratropical flora of the South American continent. Dr. Hooker has given an admirable figure of this species; and in describing it he acknowledges its close alliance to the genus *Tasmannia,* on account of its unisexual flowers and its few carpels, which are two of the principal characters that serve to distinguish this genus from *Drimys.* I have already alluded to the shape of its stigma, which has quite the peculiar form of that of *Tasmannia,* and to its stamens, which also correspond to that genus; and to these features may be added, that its leaves are deficient of the peculiar glaucous under surface that universally marks those of *Drimys*; they are, on the contrary, concolorous, extremely reticulated, and the petiole is slightly winged, as in *T. insipida.* I have observed, in the same specimen, female flowers with no stamens, and only a single ovary; and hermaphrodite flowers with thirty stamens in four rows, and one ovary: others have four ovaries; and in all three cases I found eight petals in two series.

3. ILLICIUM.

This genus is too well known, and its relation to *Drimys* and *Tasmannia* is too well established, to require much notice; but I will offer a few observations upon its seed, which in its structure is quite analogous to that of the genera just mentioned. The best details of the generic features of *Illicium* are given in the admirable work of Dr. Asa Gray, 'The Genera of the United States,' where, in plate 21, there is an excellent analysis of *Illicium Floridanum,* from which we may conclude that there is no essential difference in the structure of the American and Asiatic species; all that may be noticed is, that in the latter I have observed that the stamens are not introrse, as there seen, but that the anther-cells are imbedded laterally on each side of the fleshy filament, and that the three rows of stamens are fixed upon the outside of a very short gynophorus, in the summit of which the verticillated ovaries are partly sunk. Dr. Gray describes the external brittle tunic of the seed as loosely adhering to the "obscurely sculptured surface of the spongy membranaceous inner integument." According to my observations on *Illicium anisatum*, the single seed, found in each of its follicles, is of an oval form, laterally much compressed, very hard and polished, and lies with its longest diameter horizontally and its transverse diameter vertically within the radiating pericarp, where it is attached to the axile placenta by its hilum, which there forms a large hollow cavity closed by a fungous substance: along its upper margin is a somewhat prominent ridge, which has been described as the raphe; but this is not correct, although the cord of the raphe exists below it, but in no way connected with it: this ridge is formed merely by the pressure of its growth against the corresponding sutural line of the pericarp. This outer shell of the seed is hard, crystalline, and somewhat brittle, consisting of a number of hexagonoid cylinders, which, under the microscope, appear formed of radiating spicula subsequently filled towards the external face with solid crustaceous matter; it is uniform in thickness and texture, except round the open mouth of its large basal aperture, which is closed by the fungous hilum; it is there somewhat thicker; it is lined throughout with a thin, pellicular, loosely adherent membrane with very distinct, large, oblong reticulations, and which is easily scraped off. Between this and the next coating is a layer of very elongated oil-cells or glands, in three or four adhering layers, which do not always run parallel with one another, but often cross, so as to form cancellated bands, thus producing the bullate and "sculptured surface" mentioned by Dr. Gray: these oil-cells are coloured, translucent, with a minutely dotted surface; and they dry into a brittle furfuraceous stratum, quite free from the surrounding integuments. The next tunic is very thick and fleshy, and may be detached in an entire state; it appears to be a continuation of the more solid or fungous hilar portion, near which it becomes gradually and considerably thickened: within the fleshy tissue of this integument is found the simple cord of the raphe, consisting of spiral and other vessels, which, originating in the hilum, runs along the upper margin, and terminates near the other extremity in the chalazal disk. The nucleus, which completely fills this sac, is considerably smaller, of an oval shape, somewhat less compressed, and a little rostrated where it points towards the hilum, which has a corresponding hollow for its reception; this is covered by two distinct membranes, of which the outermost or third integument is reticulated with long polygonoid areoles, while the next or fourth integument, which immediately invests the albumen, is somewhat thicker than the former, and has very minute hexagonal reticulations, the areoles of which are smaller than the cells of the albumen: these two membranes are homogeneous throughout, and are easily separable from one another at all points, except at the chalaza, where, together with the second fleshy tunic, all three are intimately confluent. The albumen is fleshy; and imbedded in its substance, close to the rostrated point before mentioned, we find the embryo, which is extremely small and shortly cylindrical, the radicular end pointing to the hilum, the opposite extremity being cleft into two very minute gaping cotyledons. From these facts I infer that the outer testaceous shell is an arillus, developed probably from the placenta, and that the whole of the fleshy spongy coating (together with its included raphe and its fungous hilum) is a growth or expansion of the placentary sheath of the ovule, thus forming an investing entire sac, and assuming the peculiar condition which I have called an arilline* or fleshy development of the primine of the ovule.

The generic character, from my observations, may be thus defined.

Illicium, Linn.—*Flores* hermaphroditi. *Sepala* 3 vel 6 petaloidea, membranacea, æstivatione imbricata, caduca. *Petala* 9 ad 30, patentia, 3-pluri-serialia, interiora angustiora et minora, æstivatione imbricata, decidua. *Stamina* indefinita (12 ad 40), pluriserialia, hypogyna, patentia; *filamenta* brevia, carnosula; *antheræ* adnatæ, loculis segregatis margine filamenti semi-immersis, sublateraliter dehiscentibus. *Ovaria* 5–15, compressa, sessilia, libera, suberecta, serie unica gynophoro brevi insidentia, 1-locularia; *ovula* solitaria, ex angulo basali adscendentia, anatropa. *Stylus* subulatus, recurvus, latere ventrali stigmatosus. *Folliculi* plurimi (5–15), coriaceo-lignosi, compressi, rostrati, liberi, circa gynophorum centralem stellatim adnati et horizontaliter radiantes, sub-2-valves, rima superiore hiantes, 1-loculares, monospermi. *Semen* oblongum, compressum, hilo majusculo excavatum et hinc ad axin centralem horizontaliter affixum; tunica externa crustacea, dura, ore calloso incrassata, extus vitrea et nitidissima, intus structura hexagonoidea reticulata, et crystalloidea; tunica secunda crassiuscula, superficie bullata, extremitate hilari crassa,

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* Linn. Trans. xxii. 89.

raphigera, raphide simplici hilo orta per marginem superiorem protensa et chalazam attingente percursa; tunica tertia hyalina, tenuiter membranacea, areolis elongatis reticulata, versus angulum superiorem *chalaza* majuscula incrassata; tunica quarta pellucida, paullo crassior, areolis minutissimis hexagonis reticulata, ad albumen arcte adhærens. *Albumen* copiosum, carnosum, hexagonoideo-cellulosum, ovale, paullo compressum, versus hilum rostratum, hinc embryonem minimum claudens, *radicula* cylindrica, hilum versus spectante, et in *cotyledonibus* obtusis brevissimis centripetis fissa.

Arbusculæ *Indicæ, Chinenses, Japonicæ, et boreali-Americanæ sempervirentes;* folia *alterna, oblonga, integerrima, glabra, coriacea, pellucido-punctulata, sæpe conferta;* flores *axillares vel in ramulis annotinis terminales, tandem ramuli novelli elongatione laterales,* pedunculis *solitariis aut ternis* 1-*floris,* petalis *purpureis aut flavescentibus,* capsulis *aromaticis vel insipidis.*

1. *Illicium anisatum,* Linn. Sp. 664; Gaertn. Fr. i. 338. t. 69; Dict. Méth. i. 351; Lam. Ill. t. 493. f. 2; DC. Syst. i. 441; Prodr. i. 77; De Vriese et Hoeven, Tijd. i. 31–45. t. 2.—In Japonia et China*.

2. *Illicium religiosum,* Sieb. et Zucc. Fl. Jap. i. 5. t. 1; Bot. Mag. t. 3965; Walp. Rep. i. 74.—In Japonia.

3. *Illicium Griffithii,* Hook. f. & Th. Fl. Ind. i. 74.—In montibus Khasia.

4. *Illicium Floridanum,* Ellis, Phil. Trans. lx. 524. t. 12; Dict. Méth. i. 352; Lam. Ill. t. 493. f. 1; Gaertn. Fr. i. 339; Bot. Mag. t. 439; DC. Syst. i. 441; Prodr. i. 77; Gray, Gen. Un. St. i. 56. t. 21.—In Florida.

5. *Illicium parviflorum,* Mich. Fl. Bor. Amer. i. 326; Vent. Cels. t. 22; Hb. Am. t. 330; DC. Syst. i. 442; Prodr. i. 77.—In Florida.

4. Temus.

Of this genus nothing is known beyond the very imperfect description given by the Abbé Molina in his 'History of Chile;' and as no plant corresponding with it has since been found by any of the numerous collectors who have visited that country, the genus must be considered a very doubtful one. It was placed by DeCandolle between *Illicium* and *Drimys,* although the character ascribed to it by Molina was incompatible with them; but he considered that character to be, in all probability,

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* Analytical details of the fruit and seed of this species are shown in plate 27 c.

erroneous, because a dicoccous berry is hardly consistent with the previous condition of two ovaries. It is described as a tree with alternate, thick, polished, oval, smooth, and bright green leaves, that emit a strong smell of nutmegs; terminal aromatic flowers, with a 3-fid calyx, eighteen linear petals, twenty-six stamens, two ovaries, and a dicoccous berry; the petals are linear, flesh-coloured, two or three inches long; the filaments are setaceous and above half the length of the petals, with globose anthers; the seeds are arillate, with the flavour of those of coffee, only more bitter. This kind of fruit ill accords with the features of the *Winteraceæ.* Until further evidence of its existence, and better characters of its structure be ascertained, it ought to be restored to the list of the "genera incertæ sedis," in which it was placed by Jussieu. I cannot help thinking there must have been some confusion in the original notes of Molina: he describes his *Temus moschata* as furnishing an excellent and very hard wood, which cannot be of rare occurrence, as he says it is much used in Chile in various manufactures. The *Luma Cruckshanksii,* A. Gray (*Eugenia Cruckshanksii,* Hook.), which is abundant in the midland provinces of Chile, is known among the natives by the name of Temu; and it possesses a wood that answers the above description.

5. Trochodendron.

This genus, established by Siebold and Zuccarini for a plant which the former botanist brought from Japan, has been fully described and figured in the 'Flora Japonica.' It has been referred to the neighbourhood of *Illicium*; but its characters seem quite irreconcileable with those of the *Winteraceæ.* The features which appear to me incompatible are—its verticillated leaves, which are serrated; its peculiar mode of budding; its flowers destitute of both calyx and corolla; its single plurilocular ovary; and its capsular fruit, opening by five to eight thick coriaceous valves; to which may be added, the different sort of integument by which its seeds are invested. On the other hand, in the habit of the plant, its serrated leaves, its numerous stamens, its many-celled ovary, with divided style, its capsular many-valved fruit, and the form and texture of its seminal integument, it approaches far nearer to the *Ternstrœmiaceæ*; and it has several features in common with *Trochostigma,* also of Japanese origin (*Actinidia,* Lindl.), placed by some botanists in *Ternstrœmiaceæ,* by others in *Dilleniaceæ*; but perhaps it comes still nearer to the Tasmannian *Carpodontos* (congeneric with *Eucryphia* from Chiloë), a genus of doubtful position placed between the *Chlænaceæ* and *Ternstrœmiaceæ.* In the latter genus the corolla is very deciduous, and its opercular calyx at the period of æstivation falls off by a circumscissile line, —a character approximating to the seemingly achlamydeous flowers of *Trochodendron*.

ON A NEW SPECIES OF LARDIZABALA, AND ON THE STRUCTURE OF THE SEED IN THAT GENUS.

The structure and affinities of the genera of the *Lardizabalaceæ* were scarcely known before the publication of the excellent monograph of M. Decaisne above twenty years ago, when the family was first established. Since that time little has been added to our knowledge of the order, except the interesting remarks of the authors of the 'Flora Indica,' who have described the Asiatic species, and have added a new and remarkable genus, which they have gracefully dedicated to the very eminent botanist before mentioned, the type being the *Decaisnea insignis*, a native of the Himalayas. M. Decaisne considered the family to be intermediate between *Schizandraceæ* and *Berberidaceæ*; and Prof. Lindley indicated its nearer affinity with the *Menispermaceæ*, at the head of which order it had long previously been placed as a distinct tribe by DeCandolle (*Lardizabaleæ*, Prodr. i. 95). In my memoir upon the *Winteraceæ* I have pointed out the intimate relationship existing between those two families.

It has been generally understood that the numerous ovules in the ovaries of the *Lardizabalaceæ* are scattered indiscriminately over the whole internal surface of the cell; but Drs. Hooker and Thomson show that in *Decaisnea* the ovules are confined to two regular lines of placentation, which they notice as an exceptional case, contrary to the condition which has been considered the chief characteristic of the order. In *Lardizabala*, a genus belonging exclusively to Chile, I have found that the ovules, in a similar manner, originate in six distinct parallel parietal placentæ, running from the base to the apex; and in the fruit, the seeds are likewise arranged in as many parietal lines. The distinguished botanists just mentioned also state that in *Decaisnea* the ripe fruit is filled with a cellular pulp, which is developed from the whole surface of the growing wall of the pericarp, thus forming a complete homogeneous mass, without leaving any cavity; and although this pulp firmly embraces the seeds, they observed no real adhesion except at the hilum, where there is a broad organic attachment between it and the external tunic: vessels originating from all parts of the surface of the pericarp ramify through the pulp, but do not meet in the axis of the fruit. A very similar development exists in *Lardizabala*, where the internal space of the fruit is filled with an edible gelatinous pulp: as the fruit dries, this pulp contracts into a pellicular covering that closely invests the black external tunic of the seeds, and within the substance of which numerous spiral vessels are distributed. It appears to me that this pulp is a secretion originating from the funicular point of attachment of each seed to the placenta, rather than an emanation from the entire surface of the cell; for round the hilar foramen in the seed of *Lardizabala* there exists a light-coloured annular cicatrix, which probably indicates the organic point of connexion of the pulpy envelope with that part of the external tunic, as described in the manner above-mentioned in *Decaisnea*, and which also forms the point of its junction with the placenta; for it will be shown that within a cavity of the external tunic there exists an expansion of the funicular mass, which evidently maintains that connexion through the hilar foramen before alluded to.

There are some peculiarities in the structure of the seed in *Lardizabala* that are worthy of attention. The seeds are ovoid, unequally gibbous, always more or less compressed, somewhat angular by the force of mutual pressure, and straighter upon the face next to the pericarp. The hilum, situated below the middle upon this face, consists of a rather small and somewhat oval aperture, which is filled with a fungous substance that becomes fleshy when moistened, and which is continuous with a mass of similar substance filling a large cavity within the tunic. This outer tunic, usually considered as the testa, is dark-coloured, thin, and somewhat chartaceous; and within it is found an inner coating consisting of two distinct adherent integuments. The albumen forming the enclosed nucleus is somewhat corneous, with a large hollow chamber on the side next the hilum; the two integuments last mentioned closely invest the inner surface of this chamber, as well as the external face of the albumen, but the outer shell is in no way inflected into the cavity. If we cut through a seed longitudinally across the line of the hilum, the albumen in this section appears of a gibbously hippocrepical form, with a large ovoid hollow space towards the centre; the two extremities of this horse-shoe are widely apart, the space in the form of a broad plate being filled with the fungous mass before mentioned. If we now cut through another seed in a transverse direction across the hilum, we find the hollow space deep and narrow, the albumen appearing in the shape of a more compressed horse-shoe, of which the crura are parallel; and in the vacuity is seen the same fungous substance in the form of a flattened plate, between which and the integuments lining the cavity there exists a very narrow space, showing that it is quite free from them in all parts, except at the periphery of the flattened plate, where it is attached to them by means of a very distinct cord or raphe filled with numerous spiral vessels. This raphe is observed both in the vertical and transverse sections, where it forms a broad hollow tube partaking of the nearly circular shape of the cavity, the inner surface of the tube being lined with a close web of white spiral vessels; it is seen to originate at one of its extremities in the hilar foramen of the outer tunic, and after making nearly an entire circuit, it returns close to its starting-point, where it disappears in the chalaza of the inner integument, over the nidular place of the embryo. The embryo is very small, and is best seen in the longitudinal section, where it is found imbedded in the albumen in the extremity of the lower leg of the horse-shoe, or that nearest the hilar foramen of the outer tunic: it lies somewhat obliquely, with its radicle pointing outwards to a small external prominence of the albumen, and with the cotyledons directed towards the centre of the seed: the radicle is terete, short, obtuse, and of the length and breadth of the cotyledons, which are pointed and much compressed, its whole length being twice its own diameter, and about $\frac{1}{12}$th of the total length of the seed.

On examining this evidence, we readily discern the nature of these several parts: the inference that the outer tunic, which has hitherto been denominated the testa, is of extraneous origin, and therefore of the nature of an arillus, is supported by four reasons:—1. Because it is not likely that the fungous plate, or large funicular expansion found within the cavity of the seed, could have found its way from the exterior into the hollow space through the small hilar foramen of the outer coating; on the contrary, it is more reasonable to conclude that this outer tunic must have been a subsequent formation after the ovule had become convoluted round that excentrically expanded support. 2. Because, had this tunic been the testa, that is to say, a simple development of the primine of the ovule, it would have exhibited some trace of its organic connexion with the other integuments, especially about the region of the chalaza, and would have partaken of the same form, and have been drawn along with them into the cavity. 3. Because this outer tunic is not only completely free from all contact with the raphe, but is far remote from and exterior to it, and therefore it must necessarily have been of a growth posterior to the curvature of the ovule. 4. Because the integument resulting from the growth of the primine is indicated beyond all doubt by the presence of the cord of the raphe within its substance: it is the more fleshy and exterior of the two integuments which immediately invest the albumen, following it in its excentric curvature, and adhering along the line of the raphe to the peripherical margin of the funicular plate. It would certainly be very incorrect to call this fleshy coating a *testa* : indeed it was for a similar reason that I proposed for the analogous coating in *Clusia* and *Magnolia* the term "arilline," in order to distinguish it from another more internal *testaceous* tunic, which is destitute of vessels of any kind. In fine, any one who will take the trouble to reflect on the consecutive changes that must take place in the development of the seed, and will keep his attention fixed upon the continuity and movement of the coats of the ovule during their excentric development and subsequent growth, must perceive how absolutely impossible it is that the external shell, circumstanced as we find it in this instance, can have derived its origin from the mere increment of the primine.

If we examine this external shell, we find it to be a thin, black, chartaceous or coriaceous entire crust, easily separable from the rest of the seed, owing to the deposition between it and the proper seminal integuments of a quantity of loose cellular tissue, mixed with coloured glands, which adhere to one as well as the other, and give to both a furfuraceous appearance. The coating which immediately invests the entire surface of the albumen in all its curvatures is composed of two distinct tunics, which, though adhering together, are separable. The outer one is soft, opake, and somewhat fleshy, containing numerous distinct cells, apparently filled with oily matter; it is much thicker around the region of the large hollow raphe: the inner integument is thin and membranaceous, and closely invests the albumen: both are also thickened around the chalazal point, which is situated in the lower part of the cavity near the site of the embryo.

It is said that in some of the *Lardizabalaceæ* (*Akebia* and *Hollbœllia*) the ovules and seeds are partly imbedded in the fleshy walls of the pericarp; but in *Lardizabala* the reverse of this takes place; for here there is a protrusion of a part of the placenta, forming an expanded funicular support, about which the ovule bends itself, and becomes peltately convex around it,—the whole, as I have above shown, becoming subsequently enveloped by a complete arillus emanating probably from a growth of the placenta, or of its funicular extension. A metamorphosis of an analogous kind, that is to say, an excentric replicature of the ovule round its funicular support, occurs in the seeds of the tribes *Heteroclinieæ* and *Anomospermeæ* of the *Menispermaceæ*, only that in these cases there is no extraneous growth of any enveloping arillæform tunic, such as we find in *Lardizabala* : in the former cases, where the carpels are always unilocular and uniovular, and where the growth of the pericarp is constantly upon its dorsal face, while that of the ventral face is more or less stationary, it is easy to conceive how the ovule in its growth partakes of a similar kind of increment, and becomes moulded round the stationary fulcrum of its placentary attachment. But in *Lardizabala*, where the ovaries are multiovular, the partial protrusion of the placenta is not accompanied by an expansion of the walls of the pericarp. Something more analogous, however, occurs in the *Myrsinaceæ*, where the ovules often become moulded round the globular free placenta, and an arillus, in the shape of an inflated entire membranaceous sac, generated from the root of the placenta, encloses the seed together with its support *.

There is, however, a close analogy in the structure of the seed of *Lardizabala* with that of the *Winteraceæ* and *Canellaceæ*, if we except the circumstance of the deep cavity in the albumen, which does not occur in the two latter families. We find in all these cases a correlative, peculiar outer crustaceous shell; in the next place we see the same corresponding intervening layers of loosely aggregated oleiferous cells; then a similar fleshy tunic enclosing the cord of the raphe, and a still inner integument investing the albumen,—all bearing a striking analogy to the structure I have described in *Illicium* †. This structure shows the very close affinity that exists between the families last mentioned and the *Lardizabalaceæ*; and in discussing the question of these affinities with other orders of the *Polycarpicæ*, I have already suggested the place that the *Lardizabalaceæ* should occupy, relatively to them, in the system ‡.

Ruiz and Pavon, who founded the genus *Lardizabala*, mention (Syst. i. 286) two species, both natives of Chile, the one with biternate oblong leaflets unequal at their base, the other with triternate ovate leaflets. DeCandolle (Syst. i. 512) amplified these brief characters by fuller details founded on his observation of dried specimens, adding at the same time the feature of the peculiar petiolar leaflets, which he termed bracts, and which he described as being round and cordate in the former case, and oblong in the other: he observed respecting the latter, that he found the leaves always biternate, as in the other species, not triternate, as mentioned by Ruiz and Pavon. *L. 3-ternata* was subsequently figured in Delessert's 'Icones,' i. 24. tab. 91, where the leaves are all divided biternately, and the leaflets are represented sometimes inequilateral at base, or partially lobed and mucronate, more or less regularly oblong or ovate, and subobtuse or acute. We find, moreover, in the same specimen the petiolar leaflets either cordate or rounded at base, orbicular or ovate, entire or denticulated. I cannot, therefore, perceive any permanent characters corresponding with the two species abovementioned, and certainly all the specimens I have seen are referable to one species. From the marked manner in which some of the leaflets in *L. biternata* are lobed, it is not unreasonable to suppose that the leaflets may sometimes become further subdivided; but that must be considered as a very exceptional feature. The specimens grown in this country, from which Sir Wm. Hooker made his drawing in Bot. Mag. tab. 4500, bear a rather different aspect, with the leaves somewhat modified in form and texture, from those of native specimens; but that probably is the result of garden cultivation. The plant there described was brought from Concepcion, where it is stated to grow abundantly, and is no doubt identical with the specimens in our herbaria collected in the same neighbourhood.

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* I will at some future time describe the observations I have made on this singular structure.

† *Ante*, p. 141.

‡ *Ante*, p. 126.

The small leaflets at the base of the petiole have always been considered as bracts, but they appear to me to partake more of the character of stipulary leaves, for the following reasons:—The peduncle, both of the male and female inflorescence, springs out of the middle of a bud-like verticil of small, erect, squamaceous, hairy bracts, similar in size and shape to those found at the base of the pedicels; this cluster of bracts grows out of the middle of a conspicuous gland-like prominence, seated on the stem, a little above the petiole; and it is from the margin of this prominence that these leaflets emanate: this difference in the place of their origin shows that they should be considered as stipules rather than bracts. They occur both in the floriferous and barren axils, and therefore appear to have nothing to do with the inflorescence; the real bracts are always hairy, while these leaflets are smooth and veined, with a texture exactly resembling that of the leaves. I have occasionally seen a verticil of three of these leaflets at the base of a petiole.

During my residence at Concon, about twenty miles from Valparaiso, now thirty-five years ago, I found growing in its neighbourhood a species of *Lardizabala* in flower and in fruit, specimens of which I still possess. Concluding it to be a plant well known and described, I did not then bestow any particular attention upon it; and it was only by comparison with other specimens in different herbaria, after my return to England above twenty years afterwards, that I found it to differ essentially from *L. biternata.* I do not remember to have seen the male flower, at least I have no fragment or note of it: the flowers in my specimen are female, with sterile stamens, and they appear to me larger than in the other species. In the ordinary species the leaves, as before stated, are always biternate, or ternarily divided into nine leaflets, the lateral ones being inequilateral and sessile, generally very glabrous and polished; all the leaflets are more or less acuminated at base, and often at their summit, are at least twice as long as broad, triplinerved, the lateral nervures springing at some distance from the petiole, are thicker in texture, opake and somewhat coriaceous, while the primary and secondary petioles are longer in proportion. On the other hand, in my plant the leaves are simply trifoliate or divided into only three leaflets, as in *Boquila*; the leaflets are much larger in size, nearly as broad as long, conspicuously cordate and broadly truncated at base and obtuse at their summit, with a terminal mucro; they are all equilateral, quintuplinerved, the nervures originating at the base; they are very reticulated, much thinner in texture, more transparent, and are deeply sinuated on the margin, the nervures in each salient angle (of which there are six or eight on each side) terminating in a long cuspidate excurrent point: the lateral leaflets are both petiolulated; the main petiole and three petiolets are comparatively shorter, and they, as well as the nerves and veins beneath, are all pubescent. In another specimen gathered at the same spot, and accompanying the fruit, the leaves are much smaller, also simply 3-foliate, the leaflets being more regularly obovate, slightly cordate, very opake, coriaceous, quite smooth, with thickened margins, which are almost entire or finely crenulated; in other respects it corresponds with the above-mentioned specimen, and is evidently taken from the end of a branch, as its stem is thin and very twining.

In *L. biternata* the stipulary leaves are large, orbicular, and sessile; in my plant only one remains, which is very small, linear, and attenuated at its base. The fruit is similar in size and shape to that of *L. biternata,* as figured in the Prodromus of the 'Flora Peruviana.' The plant I have described is known at Concon as the Coguil, being the same name as that given in Concepcion and the southern provinces of Chile to the plant of Ruiz and Pavon. 'Coguil' is properly the name of its edible fruit, 'Coguil-boqui' that of the plant, the word 'boqui' being applied alike to all scandent shrubs: the names attributed to it of 'Aguilboquil' and 'Guilboquil' by Dombey and La Perouse are certainly typical errors. In most botanical works, *L. triternata* is said to be a native of Peru, at Arauco; but this is a mistake common to most of the specimens collected in Chile by Dombey. Arauco is a province bordering on that of Concepcion, and separated from it by the river Biobio.

The following is offered as an amended character of the genus:—

Lardizabala, R. & P.—Flores polygamo-dioici. Masc. *Sepala* 6, alternatim biseriata, carnosula, exteriora ovata, æsti-

vatione valvata, interiora angustiora, spathulata, acuminata. *Petala* 6, biseriata, oblongo- vel lineari-lanceolata, acutiuscula, exteriora paullo latiora. *Stamina* 6; *filamenta* in tubum monadelphum coalita; *antheræ* extrorsæ, adnatæ, 2-loculares, connectivo breviter apiculatæ. *Ovaria* 3, rudimentaria, plus minusve attenuata. Fem. *Sepala* 6, biseriata, crassiuscula, campanulatim expansa, exteriora oblonga, versus basin attenuata, concava, interiora alternantia angustiora, imo spathulata. *Petala* 6, sepalis triplo breviora, biseriatim alterna, lineari-lanceolata, utrinque attenuata. *Stamina* 6, libera, hypogyna, gynophoro brevi inserta, petalis dimidio breviora; *filamenta* teretiuscula; *antheræ* eorundem longitudine oblongæ, 2-loculares, connectivo apiculatæ, effœtæ. *Ovaria* 3*, teretia, cylindrica, medio extus gibbosa, unilocularia: *ovula* numerosissima, ad placentas 6 longitudinaliter, parietales prominentes horizontaliter affixa, campylotropa. *Stylus* brevis, obtusus, ovario continuus. *Stigma* sessile, glandulosum. *Baccæ* 3, majusculæ, cylindricæ, torulosæ, stylo apiculatæ, polyspermæ. *Semina* subovata, gibba, compressa, fusca, in pulpam mucilagineam nidulantia, *hilo* infra medium marginali, parvulo, foramine pertuso: *tunica externa* testacea, fragilis; *integumenta propria* dupla, subadhærentia (exteriori subcarnoso raphigeri, interiori submembranaceo), albumen profundissime excavatum arcte vestientia, et circum *podospermium* magnum internum fungosum compresso-ovatum *raphide* tubuloso annulari cinctum configurata: *albumen* huic modo hippocrepice et profunde excavatum, acetabuliforme, magnum, carnosum: *embryo* marginem versus inferiorem acetabuli oblique inclusus, parvus, subteres, *radicula* cylindrica, infera, *cotyledonibus* compressis centripetis æquilonga et æquilata.

Frutices Chilenses *scandentes*, foliis *alternis, ternatis vel biternatis, petiolatis*, foliolis *integris, vel sinuato-dentatis, coriaceis, nitidis, glabris, vel parce pubescentibus*, petiolo *refracto, imo* stipulis *foliaceis, sæpe rotundatis et majusculis donato*; pedunculo *glabro e gemma squamiformi axillari orto, in masculis plurifloro*, floribus *breviter pedicellatis, racemosis, bracteolatis*, bracteolis *acutis, ciliolatis; in fœmineis unifloro, flore majori ebracteato; floribus omnibus purpureis.*

1. *Lardizabala biternata*, R. & P. L. triternata, *R. & P. Prodr. Fl. Peruv.* 143. tab. 37; *Syst.* i. 286; *DC. Syst.* i. 512; *Prodr.* i. 95; *Delessert, Icones*, i. tab. 91; *Decaisne, Archiv. Mus.* i. 187. tab. 11; *Hooker, Bot. Mag.* tab. 4501.—Chile (Concepcion et Quillota).

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* Interdum 6 secundum DeCandolle, Syst. i. 512, sed dubia.

2. *Lardizabala sylvicola*, nov. sp. ♀;—ramulis volubilibus, striatis, glabris; foliis 3-foliolatis, foliolis basi æqualibus, ample ovatis, late truncatis et subcordatis, obtusis, submembranaceis, margine cartilagineo, hinc inæqualiter sinuatis, angulis cuspidatis, 5-nerviis, valde reticulatis, omnibus petiolulatis, petiolulis lateralibus petiolo subæquilongis, intermedio 2-plo longiori, omnibus summo et imo incrassatis nervisque pilosulis, petiolo e basi subito refracto; stipulis axillaribus parvis, lineari-spathulatis, glabris, venosis, mucronato-denticulatis; foliis terminalibus multo minoribus, glaberrimis, coriaceis, fere integris, margine cartilagineo crenulatis; floribus speciosis, violaceis, axillaribus, solitariis, pedunculo elongato, summo incrassato, e fasciculo bractearum orto, et paullo supra basin bractea unica donato, bracteis parvulis, acutis, margine ciliatis; sepalis amplis in campanulam dispositis; fructibus magnis, toruloso-cylindricis, edulibus.—Chile (apud Concon).

I found this plant at Concon, midway between Valparaiso and Quillota, in a wood that surrounds a small valley well sheltered by hills, called "Potrero del Peral." The short portion of the stem of the branchlet in my specimen is of the thickness of a goose-quill, somewhat flattened, and probably of a first year's growth, as it has a pithy medulla; the petiole, suddenly refracted backwards, is about 9 lines long, and much thickened at its base; the two lateral petiolets are 7 lines long, while the intermediate one measures 18 lines; the terminal leaflet is 3 inches long, and 3 inches wide at its broadest part, whence it is somewhat narrower towards the summit, which is round and emarginated, with a mucronate point; the lateral leaflets are 2½ inches long and 2¼ inches broad; the stipules are minute, compared with those of the other species, and instead of being orbicular, cordate, and sessile, are linear and tapering to a small point at base; they are 3 lines long, barely a line broad, strongly reticulated, with a mucronately dentate border. The peduncle is 1½ inch long, somewhat slender below, and thickened towards its summit; about half an inch above its base it has a small, single, acute bract, which has ciliated margins, and it bears at its base a fascicle of similar bracts which rises out of a warty prominence situated just above the petiole, and it is upon the margin of this prominence that the stipules originate. The flower is expanded into a broad bell, with a reflected margin, which is 1 to 1¼ inch in diameter; the three outer sepals are 10 lines long and 5 lines broad, somewhat obtuse at their summit, and narrower toward the base; the three inner sepals are 9 lines long, 3 lines broad, more acute at the summit, and still narrower at base. The six petals are shorter, almost linear, obtusely acuminate at the summit, attenuated at the base, and nearly equal in size, 5 lines long and 1 line broad in the widest part; the stamens are 3 lines long, the filaments being slender below, swelling above into a thick, fleshy, fusiform connective, in which the two sterile anther-cells are extrorsely imbedded, the connective terminating in a curved excurrent point. The three ovaries are 7 lines long, 1¼ line in diameter, 1-locular, with six projecting parietal parallel placentæ, each bearing a number of minute, almost peltate ovules, supported upon a short prominent funicle, with a horizontal or sub-ascending direction. The fruit is cylindrical, torulose, six-grooved, apiculated by the persistent style, 1¾ inch long, 1 inch in diameter; the pericarp is thin and coriaceous, extremely friable and of granular texture when dry; it is unilocular, and filled with a mucilaginous pulp, of a pleasant, sweet, and subacid taste, which dries into a thin epidermis that invests the seeds, and leaves a vacuity in the centre, without the vestige of any division. This is contrary to the statement of Ruiz and Pavon and other authors, who describe the fruit of *L. biternata* as being 6- or 8-locular. The seeds are very numerous, ovate, somewhat compressed, often subangular by mutual pressure, and are attached to the wall of the pericarp in a somewhat horizontal position by a small hilum; they are arranged in six very distinct series; they are about 5 lines long, 4 lines broad from the hilum to the more convex side, and 3 lines broad in the other transverse direction. Their structure has been already fully described*.

I have lately observed, in the herbarium of the Paris Museum, another undescribed species of this genus, the description of which I here append to the former:—

3. *Lardizabala infuscata*, n. sp.;—volubilis, foliis biternatis, foliolis ellipticis apice vix acutis vel obtusiusculis, puncto calloso onustis, terminalibus in petiolulum longiusculum cuneatis, lateralibus sessilibus basi inæqualibus et obtusioribus, glaberrimis, crasso-coriaceis, supra intense fusco-viridibus, nitentibus, simpliciter nervosis, nervis patentibus immersis, subtus pallidioribus brunneis, lucidis, costa nervis venisque prominentibus, marginibus revolutis integris vel obsolete crenulatis; stipulis orbicularibus majusculis, fuscis; racemis ♂ axillaribus folio sub-brevioribus.—Chile Australis: v. s. in herb. Mus. Paris (Hombron, Voyage de l'Astrolabe et Zélée).

This species is at once recognized from *L. biternata* by the extremely dark colour of its leaves and by their much greater thickness and opacity, thus offering a strong contrast to the light green colour of the typical species. In the latter the leaflets are 3-nerved from near the base, but in this plant no such lateral nerves are present; in the typical species a portion of the early pubescence is always found remaining upon the nervures and petioles, but here they are quite free from hairs; the petioles of the intermediate leaves are also much longer in this species. The internodes between the axils are 2½ in. long; the leaves altogether are 3½ in. long; the main petiole is 5 lines long; the two lateral secondary petioles are 5 lines, the intermediate one 12 lines long; the lateral leaflets are 17–21 lines long, 9–11 lines broad; the intermediate leaflets are 2½ in. long, including their petiole of 3 lines, and 10–14 lines broad; the orbicular stipules are 6–8 lines in diameter; the raceme is 2½ inches long, with about fifteen alternate male flowers.

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* A drawing of this species, with full details of the structure of its flower and seeds, is given in plate 28.

On the Natural Order Styraceæ, as distinguished from the Symplocaceæ.

In my observations on the affinities of the *Olacaceæ,* seven years ago, some remarks were offered* to show the relation which that order bears towards the *Styraceæ,* on which occasion I took the opportunity of pointing out the great difference in structure that I had remarked between the *Styraceæ* and *Symplocaceæ,* which appeared to have been associated into one family upon very slight and insufficient grounds. These views were subsequently more clearly detailed in Prof. Lindley's 'Vegetable Kingdom,' p. 593, where the characters of the *Symplocaceæ* and *Styraceæ* were defined, and where analytical figures were given, showing the incompatibility of their respective structures. I was some time ago led to resume the consideration of this subject after reading the very excellent memoir of Dr. Asa Gray, entitled 'Notes on *Vavæa,*' in which this learned botanist brought forward several arguments in opposition to this conclusion. This has induced me to collect additional evidence in support of my views, and to point out in still clearer terms the normal difference of structure existing between these two families. I will prelude these observations by a review of the discrepant opinions of botanists in regard to the affinities of the *Styraceæ,* which seem to have been loosely formed, little attention having been paid to the peculiar structure and growth of the ovary, and the general carpological features that distinguish this family from all others.

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* Ann. Nat. Hist. ser. 2. viii. p. 162; *huj. op.* vol. i. p. 22.

The earliest notice of the affinities of *Styrax* is by Linnæus (1751), in his 'Philosophia Botanica,' where, in his systematic arrangement of plants, he classes *Styrax* between *Citrus* and *Clusia*, in his group *Hesperides*; but no reason is given for this association.

Jussieu (1789), in his celebrated work, 'Genera Plantarum,' p. 156, places *Styrax* in his heterogeneous order of the *Guaiacanæ*, near *Halesia*, in a different section from *Symplocos* and its allies; and at that early period he very felicitously pointed out its relation to the *Meliaceæ*.

Jussieu afterwards (1799) changed the name of his *Guaiacanæ*, at the suggestion of Ventenat, into *Ebenaceæ*, still retaining in his first section the same genera as before; but in doing this, he was dubious as to the admissibility of *Styrax* and *Halesia*, and a second time hinted at their more probable affinity towards the *Meliaceæ*.

Again, in 1804 (Ann. Mus. v. p. 419), he repeated his doubts of the relationship of *Styrax* and *Halesia* with the *Ebenaceæ*, on account of their possessing an embryo with cotyledons shorter than the radicle, and once more suggested their affinity with *Meliaceæ*, showing likewise their close analogy with *Strigilia* of Cavanilles (*Foveolaria*, R. & P.), which genus he considered to belong unquestionably to that family. He also united the several genera of his second section of the *Ebenaceæ* into one genus *Symplocos*, which he held to be the type of a distinct family, allied in some respects to *Ebenaceæ*, but having a relation towards the *Myrtaceæ* or the *Aurantiaceæ* (the last section of his *Hesperidæ*), and distinguished from all others of his former class by its ovary, at first superior and free, but afterwards inferior and invested by the persistent calyx, and signalized by its embryo with an extremely long filiform radicle enclosed in the axis of the fleshy albumen. From this it is evident that this great botanist, in that early stage of carpological science, displayed great acumen in indicating the true affinities of *Styrax*; and although the facts then known were too few to warrant any positive determination on the subject, he clearly perceived the ordinal distinction between the *Styraceæ* and *Symplocaceæ*, which succeeding botanists have been led to confound together.

The elder Richard (1808) confirmed the views of Jussieu in regard to *Styrax*, and first established the family of the *Styraceæ* (Analyse du Fruit, p. 48), which the latter had only indicated; but in doing so, he committed a great mistake, and laid the foundation of the fallacy which has since prevailed, by associating *Symplocos* with it, into which genus *Hopea* and its congeners were now absorbed.

Jussieu (in 1817), in his memoir on the *Meliaceæ* (Mém.

Mus. iii. 439) repeated his former views of the affinity of *Styrax* and *Foveolaria* with that family.

Kunth (in 1818) entirely adopted the conclusions of Richard in his description of the order *Styraceæ* (Nov. Gen. et Sp. iii. 256).

The elder DeCandolle (in 1824), in his celebrated 'Prodromus' (i. 621), adopted the views of Jussieu only as regards *Strigilia*, which he arranged in *Meliaceæ*.

D. Don (in 1825), following the indication of Jussieu, separated the *Symplocaceæ* as a distinct family, and afterwards (in 1828) withdrew from the *Styraceæ* the genus *Halesia*, making it the type of a new order *Halesiaceæ* (Jameson's Journ. Dec. 1828), —a view sanctioned by the adhesion of Link in the following year (Handb. i. 667).

Adr. Jussieu (in 1830), after much attention to the study of the *Meliaceæ*, of which order he contributed his excellent Monograph, came to a conclusion somewhat different from that of his father, before mentioned; he showed (Mém. Mus. xix. 184) that *Styrax* and *Foveolaria* (*Strigilia*) could not be separated from one another, and that both ought to be excluded from the *Meliaceæ*, although still allied to it: he thus acceded to the opinion generally entertained of the close affinity of these two genera, without bestowing further attention on them.

Lindley (in 1836), in his 'Introduction to Botany,' p. 228, following the example of Richard, united *Styrax*, *Foveolaria*, and *Halesia*, together with *Symplocos* and *Hopea* in the *Styraceæ*, as a suborder of the *Ebenaceæ*.

G. Don (in 1837), adopting his brother's example, made three distinct families of the *Styraceæ* of former authors; viz. *Symplocineæ* (Dict. iv. p. 1) for the single genus *Symplocos*, *Styraceæ* (*ib.* p. 3) for *Styrax* alone, and *Halesiaceæ* (*ib.* p. 6) for *Halesia* only.

Endlicher (in 1838), on the other hand, considered *Symploceæ*, *Styraceæ*, and *Halesiaceæ* merely as distinct suborders of the *Ebenaceæ*.

Bentham (in 1838), in a memoir published in the 18th vol. of the 'Linn. Soc. Trans.,' discussed the characters and affinities of *Symplocos*, *Alstonia*, and *Hopea*, and considered that these genera, together with *Styrax*, *Foveolaria*, and *Halesia*, constitute the distinct order *Styraceæ*, which perhaps might be held to be only a tribe of the *Ebenaceæ*: his valuable remarks were, however, confined merely to observations upon the differences existing in the calyx, corolla, and stamens, seemingly without having directed his attention to the great dissimilarity in the relative structures of the ovary and seed in these genera. He considered the affinity of the *Styraceæ* to be immediately with *Ebenaceæ* among *Mono-*

petaleæ, also tending directly towards *Humiriaceæ,* in the next instance to *Meliaceæ,* and perhaps with *Aurantiaceæ* and *Olacaceæ,* among *Polypetaleæ.*

Professor A. DeCandolle (1844), in his 'Prodromus' (viii. 244), described the *Styraceæ* as a family distinct from *Ebenaceæ,* dividing it into three groups:—1. *Symploceæ,* for *Symplocos* only; 2. *Styraceæ,* for *Styrax, Pterostyrax,* and *Halesia*; 3. *Pamphilieæ,* for *Pamphilia* and *Foveolaria.*

Professor Lindley (in 1845) entirely followed the views of DeCandolle (Veg. Kingdom, p. 593); but in his last edition of that work (1853), without expressing any opinion of his own, he there annexed the arguments, and by figures illustrated the facts, which I had communicated to him, and upon which my suggestion was based, for the separation of the *Symplocaceæ* from the *Styraceæ.* It was against these arguments, and to maintain the opinions of Prof. A. DeCandolle, that Prof. Asa Gray directed his remarks in his 'Notes on *Vavæa,*' to which I have before alluded.

28 Prof. Decaisne considered the *Styraceæ* nearly allied to *Alangiaceæ*; but in this conclusion there can be little doubt that he held *Symplocaceæ* in view, that being nearly the position I have assigned to the latter family.

Prof. Miquel (in 1856), in Martius's 'Flora Brasiliensis,' adopted the order *Symplocaceæ,* which he there described as distinct from *Styraceæ,* according to my suggestion, but without offering any comment on the matter.

Finally, Prof. Agardh, in a work just published (1858), gives quite a novel view of the affinity of the *Styraceæ,* which he is disposed to consider as a gamopetalous form of the *Tiliaceæ,* and more especially of the *Elæocarpeæ.* He seems to accord in the separation I have proposed of the *Styraceæ* from the *Symplocaceæ,* and suggests the probability that the latter family may prove to be a gamopetalous form of his group *Carpodeteæ,* which he arranges near *Cornaceæ.*

From this history it will be seen how constantly and how widely the conclusions of botanists have varied in regard to the affinities of these two small groups of plants; and this uncertainty shows a necessity for fixing their characters upon some more definite basis than has heretofore been attempted.

The affinities of the *Styraceæ,* and the mutual relationship of the several genera there associated, have hitherto been founded on the more trivial characters of the relative number of the stamens, and their cohesion at their base upon the petals, which at this point often become pseudo-gamopetalous by mere agglutination; while, on the other hand, no stress has been laid on its other far more essential carpological characters. Although it be true that in forming our judgment regarding affinities, we should trust to the assimilation of several features rather than to few, still the precept of Jussieu should be attended to, that the most constant elements are to be observed in the principal organs of reproduction, especially those of the ovary and seed, and that these characters therefore should hold a prior claim over other concomitant, more variable, and less important features, in our investigations into the mutual relations of plants. This rule appears to have been wholly disregarded, in respect to the *Styraceæ,* by nearly all the botanists who have written on this family. Notwithstanding that the diagnostic features of the genera are severally drawn up in a very elaborate and careful manner by Prof. A. DeCandolle, in his excellent monograph of the order, the differential characters of the tribe *Symploceæ* (Prodr. viii. 246) and those of the *Styraceæ* (p. 259) are confined wholly to the dissimilarity in the æstivation of the corolla, the number of stamens, and the size of the cotyledons in relation to the radicle: no comparison is made of the structure of the ovarium, which is so essentially different in these two groups; and although these last-mentioned features are respectively given in the generic details of *Symplocos* and *Styrax,* no inference in an ordinal point of view has been drawn from structures so totally distinct, and which it is difficult to reconcile under the same category.

Before I proceed to consider the affinities of these two groups, I will offer some details of the structure of their ovary, as well as of their fruit and seed. In the *Symplocaceæ* we have an ovarium composed of five (rarely fewer) carpels completely united around a central axis, which is placentiferous in its upper portion and continuous with the style, so that the cells are perfect and separated by as many complete partitions, which retain their integrity in the ripe fruit. In those cases where some of the cells are occasionally abortive, even where only one cell is perfected, the remains of the other cells, together with their previous axis, may always be distinguished in that portion of the paries which is thickened about that line. Hence it constitutes an essential feature in this family to have a plurilocular ovary, the margins of its carpellary leaves being always placentiferous and united together in the axis, so that the cells thus formed are complete from the base to the apex.

On the other hand, in *Styraceæ* we find a central placentation, more or less abbreviated, sometimes almost obsolete, which has never any connexion with the style, and hence the summit of the ovary, in a greater or less degree, is always unilocular; the placenta thus generally rises very little above the base of the central space, although it is sometimes elevated above the middle of the cavity: in all these cases the bottom of this central space is divided by three (in *Halesia* by four, and in *Pterostyrax* by five) short partitions, which unite with the central placenta, and, under the form of prominent parietal nervures, are continued up the wall of the ovary to near its summit, which always remains unilocular; but neither these nervures nor the margins of the short partitions of the basilar incomplete cells exhibit any ovules. The abbreviated central placenta is thick, fleshy, and ovuligerous, bearing frequently more than thirty ovules, that is to say, ten or twelve in each division, arranged in three or four rows, its surface being corrugated by as many fleshy projections imbricated on one another, and between which the ovules are imbedded to some depth: this process is not, however, observable in *Halesia.* Nothing approaching this structure exists in *Symplocaceæ.* From these facts we may conclude that the normal condition of the component carpels in *Styraceæ* is that their margins are never placentiferous, and do not unite in a solid axis, and consequently are never continuous or connected with the style; and the inference, in a theoretical point of view, is that the origin of the 13. central placenta is due to the union of the petiolar bases of the hypothetical carpellary leaves in one common centre, where they are ovuligerous, their margins, as above shown, being barren.

If we follow those botanists who have more or less adopted the system of arrangement planned by Jussieu, of distributing the different families of plants according to the normal structure of the ovary, the *Styraceæ* ought to find their position near the *Meliaceæ* and *Humiriaceæ,* as originally suggested by that learned botanist, that is to say, among those families where the dissepiments of a polycarpellary ovary are incomplete in their summit, the placentary axis being unconnected with the style. Upon the same ground that I endeavoured to separate the *Icacinaceæ* from the *Olacaceæ,* so should the *Symplocaceæ* be removed from the *Styraceæ.* Pursuing the same rule, the *Symplocaceæ,* from the structure of their ovary and other leading features, will be found to range near the *Alangiaceæ, Cornaceæ,* and *Hamamelidaceæ,* to which they bear the same relation that the *Icacinaceæ* have to the *Aquifoliaceæ.* This position will be seen to be very near that assigned to this family by the great Jussieu.

These conclusions are further strengthened by pursuing the comparison of the relative structures of the fruit and seed in the two groups under consideration. In *Symplocos* the fruit is a fleshy inferior drupe, crowned by the persistent toothed rim of the adnate calyx; it encloses a hard bony nut, which is generally five-celled, rarely (by abortion) three-, two-, or one-celled; only a single seed is perfected in each cell, and this is long, cylindrical, and suspended from its summit; its integuments are thin and membranaceous, and its copious albumen encloses a narrow, axile, straight embryo, of its own length, its radicle being very long, slender, superior, and pointing to the hilum, with two very minute inferior cotyledons. This structure will be seen to be very different from that of *Styraceæ*.

In *Styrax*, *Cyrta*, and *Strigilia*, the fruit, though also drupaceous, is, on the other hand, quite superior, and half enclosed within the loose, persistent, tubular or campanular calyx. In *Strigilia*, which comprises all the South American species of *Styrax*, beneath a fleshy mesocarp is a single putaminous endocarp, polished on both sides; this is thin, horny, or pergamineous in texture, almost translucent, unilocular, and monospermous, rarely two seeds being perfected within it; this endocarp has three external grooves running from the base to the apex, which correspond with as many internal nervures formed of the three projecting parietal lines seen in the ovary, and each is beautifully marked by radiating interrupted purple lines proceeding from the nervures: on removing from this putamen its fleshy epicarpial coating, it may be separated into three valves by as many 131 longitudinal sutures alternating with the grooves. The seed contained within this putamen is erect; the external tunic is hard, and marked by three longitudinal grooves caused by the pressure of the three parietal nervures of the endocarp: it is supported upon a short irregularly triangular base (the remains of the central placenta), around which may be seen twenty or thirty abortive ovules, proving, whatever be its nature or origin, that it is the external coating of the seed. This seminal tunic or shell is very osseous in texture; in *Strigilia* it is thinner and somewhat brittle, but in *Styrax* and *Cyrta* it is very thick and hard, and is everywhere polished except over its large basal hilum; upon this hilum, inclined towards one side, is seen an aperture leading to an internal channel, and in the direction of this channel the exterior face has a short, broad, prominent ridge: this channel, passing obliquely through the substance of the shell, soon reappears on the inner face in the form of a flattened bony tube, from the orifice of which a distinct cord issues, which thence extends upwards, soon divides into three branches, and then into numerous ramifications, which, crossing each other over the summit in broad bands, thus become distributed into a reticulated network that extends over the whole surface: this network, which consists of an infinity of very loose fine spiral threads, is placed between the external shell and a distinct dark-coloured membrane adhering equally to the nucleus, which thus becomes easily separated by means of its intervention; each spiral thread is, however, quite free, and is easily drawn away. Within this last-mentioned membrane is another intermediate tunic, which is very thin, colourless and transparent, and is intimately agglutinated to it. Within this, again, is found another thin, hyaline, reticulated integument, which is quite free from the former, but adherent to the albumen. The albumen is fleshy, of an oblong form in *Strigilia*, with a small nipple-shaped protuberance at its base, somewhat excentrically placed, in which is imbedded the extremity of the slender, terete, inferior radicle, while the oval, compressed, foliaceous cotyledons are situated in the middle of the albuminous mass, and are about ¾ths of its length, and somewhat narrower. This structure, with very little variation, I have found constant in *Strigilia*, *Styrax*, and *Cyrta*. The pericarp in *Styrax* and *Cyrta* is very analogous to that above described in *Strigilia*; in the two former the endocarp is more intimately combined with the mesocarp, so that in *Cyrta* the entire pericarp opens by three equal valves, although only unilocular and monospermous; in *Styrax*, these valves open only at the apex, the pericarp thus becoming cupuliform in shape, and closely investing the seed. On the side opposite to that of the origin of the raphe, a little beyond the 132 large hilum, is seen a small scar, which closes a foramen beneath it open to the interior; and in this cavity the prominent nipple, containing the extremity of the radicle, enters. In *Styrax officinale*, where the albumen is in the form of a depressed globe, the embryo lies nearly in a horizontal position, with the cotyledons slightly inclined to the hilum; in *Cyrta*, where the albumen is oval, the embryo lies in a more diagonal position; but in *Strigilia*, where the albumen is oblong, the embryo is vertical: in all three cases, the radicle points to the cicatrix seen a little on one side of the hilum. The structure of the fruit and seed in *Halesia* differs from the foregoing in many essential respects, as I will presently show; but in every case throughout the *Styraceæ* it is totally unlike that existing in the *Symplocaceæ*.

It is important to notice here, that the external shell of the seed above-mentioned is in no way analogous to the outer osseous tunics which I have described in the families of the *Canellaceæ*, *Winteraceæ*, and *Lardizabalaceæ*, and which I have shown to be arillous in their nature. Nor can it be compared to the bony shell of the *Clusiaceæ* and *Magnoliaceæ*, where it constitutes a tunic lying within the fleshy coat that bears the raphe. Here the position and course of the raphe prove that in the *Styracineæ* the osseous shell of the seed is the proper testa, originating from the growth of the primine of the ovule: we see that the whole of its fleshy mesodermic tissue has become solidified* by the deposition of sclerogen within or around its cells, and that, by the spreading of the raphe under its endodermal surface, the latter has become almost isolated from it, in the form of a separable opake pellicle. The existence of the micropylar opening, closed externally by the cicatrix before described, is a still further confirmation of the origin of the bony tunic of the seed in the *Styracineæ.*

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* This offers a strong confirmation of the view I have taken of the nature of the bony shell in the seed of *Magnolia*, which by a few eminent botanists has been thought to result from a deposition of sclerogen upon the inner face of the primine, leaving the outer face transformed into a thick

The essential differences observable in the floral structure of the two families under consideration now remain to be considered. I have already alluded to the facts long since given in Prof. Lindley's 'Vegetable Kingdom' (p. 593 *a*): these details, as before mentioned, were subsequently combated by Dr. Asa Gray;

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fleshy aril-like coating containing the vessels of the raphe; and as these two integuments are considered to be one, it has been termed "a baccate testa." On the other hand, I have suggested reasons why these coats should be regarded as essentially distinct, both in their nature and origin. I refer the reader to those arguments (Ann. Nat. Hist. 3 ser. i. 280), which show the improbability that one half of the tissues of the primine should become converted into a thick bony shell, while the other half remains soft and fleshy. On the contrary side, this last-mentioned view is defended by citing the case of the fruit of the Almond (*ibid.* 3 ser. i. 357), where the nut is supposed to be formed by the deposition of sclerogen upon the endoderm of the young carpel, leaving its outer surface unchanged in its nature to become the fleshy part of the fruit. But this conclusion appears to be founded on an unsound basis, because we have convincing evidence, from the position and course of the fila nutritoria (from their origin in the torus to the funicle of the seed), and also from the presence of the woody fibres in the substance of the nut, resulting from the lignification of the nerves of the carpellary leaf, that the nut of the Almond is a solidification of the entire carpel, and that its fleshy covering is the growth of an expansion of the torus, as DeCandolle has shown (Organ. Vég. ii. 40. tab. 43. f. 1, 2), citing *Nuphar* as an example, where a thick fleshy covering, analogous to the coating over the Almond nut, surrounds the united carpels. without any portion of its substance being interposed between them, which would necessarily occur if that coating had formed any part of the original carpellary leaves. Gaertner demonstrates the existence of a similar peripherical thick envelope around the elastic cocci of the *Euphorbiaceæ* (De Fruct. *Croton,* pl. 107; *Jatropha,* pl. 108, 109, &c.): these cocci containing manifest nervures, show us that each is an ossified, distinct, and entire carpel; their adjacent sides, which split from one another, have no indication of the intervention of any portion of the peripherical envelope, which would infallibly have taken place had that external portion ever belonged to the normal carpels. DeCandolle also alludes to the instance of *Pæonia Moutan* (*loc. cit.* p. 40, et Syst. i. 388), where the ovary, from the expansion of the torus or disk, becomes covered by a fleshy membranaceous urceole which completely surrounds it, and through the perforated apex of which the stigma is exserted; this is at first quite free, but it afterwards appears to form part of the fruit. To this source we may attribute the origin of the fleshy covering of many fruits, analogous to the instance of *Nuphar*; and we must consider the nut of the Almond as the growth of the entire carpel, and its fleshy covering as an emanation from the torus, confluent with it.

and as the reasoning he employed on that occasion is highly applauded, to the exclusion of my inferences, in a criticism in the 'Kew Journ. Bot.' vii. 139, it is necessary to test the value of the evidence on both sides. In doing this, I gladly express my full appreciation of the high merits of the distinguished Professor, which are so deservedly eulogized in the review just mentioned: my object in this is not to arraign the remarks of one so pre-eminent for the clearness of his views and the general accuracy of his observations, but to defend the evidence I had previously endeavoured to establish, the truth of which he has denied. I will therefore confine myself solely to the facts thus impugned in his 'Notes on *Vavæa*,' respecting the co-ordinal relation of *Styrax* and *Symplocos*. The grounds upon which this relationship is there defended are reducible to six heads*:—1. It is urged, that, as an inferior ovary is common to both groups, this character affords no distinguishing mark of the *Symplocaceæ*. 2. The æstivation of the corolla establishes no 134 ground of distinction, because it is imbricated in both cases. 3. It is not true, as I had stated, that the stamens are uniserial in *Styraceæ* and pluriserial in *Symplocaceæ*. 4. The feature I had implied, of the anthers being linear and dorsally attached to broad filaments for nearly their whole length in *Styraceæ*, and as being small, rounded, without connective, and slenderly affixed on the thread-like apex of the filament in *Symplocaceæ*, is not tenable. 5. The character given by me, that the *Styraceæ* may be distinguished from the other group by a superior ovary with three incomplete dissepiments, and a central placentation free from the style, cannot be maintained. 6. It is not correct to affirm that the fruit in *Styraceæ* contains a solitary one-celled putamen with a single erect seed. I will consider these objections in succession, solely in reference to facts, premising, however, that the differential ordinal characters, as sketched by me in the 'Vegetable Kingdom,' in that early stage of the inquiry, were derived mostly from my observations upon *Strigilia* and *Pamphilia*. I had not then seen *Halesia*, which, from the very discrepant characters of authors, appeared to me a doubtful genus of the order, so much so as to have been made the type of a distinct family by Don and Endlicher. Now that I am acquainted with the singular structure of that genus, my previous ordinal character will require modification; but this structure, instead of militating against my views, only tends to widen much further the differences existing between the two families under consideration.

Upon the first objection I will observe that, although it be true that the tubular and entirely free calyx which belongs to

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* Mem. Amer. Acad. 2nd ser. v. 333, in a note.

Styrax, Strigilia, Cyrta, Pamphilia, and *Foveolaria* does not exist in *Halesia* and *Pterostyrax,* this fact is of little importance in an ordinal point of view, in the presence of other more essential characters; for in some unquestionable natural orders, the *Melastomaceæ* for instance, the calyx, though usually adnate, is very often free. But this admission does not destroy the distinctive character of the *Symplocaceæ,* in having a nearly inferior plurilocular ovary, that is to say, its being enclosed within an adnate calyx from the earliest stage of its development up to the period of the ripening of the fruit. In *Pterostyrax,* on the authority of Zuccarini, the ovary is acknowledged to be half superior, as I have found it in *Halesia,* in which genus its superior moiety is free, rising above the staminiferous disk in a conical form; the calyx is at first so loosely adherent to the lower part of the ovary, that it is easily separable from it by the introduction of a blunt point. In *Styrax* and *Strigilia,* however, the ovary is wholly superior, although I have observed in *Styrax officinale* and in *Strigilia ovata* that the base of the ovary is very slightly imbedded in the torus at an early stage, while in other cases it is generally free; but even in these two instances, in a short time, by the upward growth of the ovary, this minute portion emerges, and the fruit is quite free from the calyx. In *Styrax* and *Strigilia,* the greatest increment of the ovary occurs in its upper portion, and the persistent calyx increases very little in size; but in *Halesia* there is no growth whatever of the upper portion, which remains unchanged, persistent, and crowning the fruit, the whole amount of increment being confined to the lower moiety, and with it a corresponding growth of the tube of the adnate calyx, as I will presently show.

2. Since I have been able to examine *Halesia* and *Pterostyrax,* I am satisfied that in these cases the æstivation of the corolla is decidedly imbricated, as shown by Dr. Gray; but it is certainly valvate, as I stated, in every other instance I had met with, especially in *Strigilia, Pamphilia,* and *Cyrta.* However important this feature of æstivation may be in some cases, as an accessory character, it is not considered of any ordinal importance in many families; in proof of which I need only refer to *Rubiaceæ* as furnishing numerous examples of both kinds.

3. Although it be quite true, in a general sense, as I affirmed, that the stamens are uniserial in *Styraceæ,* and pluriserial in *Symplocaceæ,* I admit that they are uniserial in *Barberina,* and that in *Halesia* the stamens are often four times the number of the petals; but in the latter case the filaments, though more numerous than usual, still only constitute a single whorl, being slenderly agglutinated by their adhesion to the base of the co-

rolla in a single series. In *Symplocos*, however, where the filaments are broad at the base, and the stamens frequently as numerous as thirty or forty, they are arranged in three or four imbricated series of different heights, and are all agglutinated by their base to the corolla for more than half their length: in *Barberina* the stamens do not exceed fifteen or twenty, and they are quite free from each other and from the corolla; but as the filaments are there very narrow at the base, they may still be normally three- or four-seried, although forced by pressure to assume a uniserial position: in *Sympleura*, however, where the number of stamens is sometimes reduced to five, they are of course uniserial, as in *Styrax*; but this does not affect the general rule. This consideration, after all, is of very trivial importance where other and far more essential points of differential structure are manifest. The point in question therefore remains valid as a common rule of distinction, especially when connected with the following consideration.

4. My definition, that the *Styraceæ* are distinguished by linear anthers dorsally attached to broad filaments for nearly their whole length, is denied by Dr. Gray, who refers to *Halesia* as showing the contrary. This character is, however, extremely prominent and constant in *Strigilia* and *Pamphilia*, where the free portion of the filament is short, and also in *Styrax* and *Cyrta*, where the filaments are relatively longer. I find also in *Halesia* and *Pterostyrax*, notwithstanding the greater comparative length of the filaments, that the anthers, still of considerable length, are linear, the two cells are parallel, separated from each other by a distinct interval, dorsally attached by their whole length, and each bursting by a longitudinal line in front, as in *Styrax* and *Strigilia*. On the other hand, in *Symplocaceæ*, in all cases I have seen, the filaments terminate in a slender thread, upon the summit of which almost oscillates a small globose anther formed of two adnate cells, without the intervention of any apparent connective, which cells burst laterally on their edges. This extreme difference may be seen by comparing the excellent analysis of *Styrax officinale* by M. Decaisne (Spach, Phan. pl. 136), and Mr. Bentham's details of *Symplocos laxiflora* (Linn. Trans. vol. xviii. tab. 18). The figures in Delessert's 'Icones,' v. tab. 42 and 43, showing the stamens of *Pamphilia* and *Foveolaria*, are not less instructive on this head. The features I have assigned to each family in this respect are therefore well-marked, and quite opposed to one another.

5. I have fully demonstrated, in a preceding page, the very different structure of the ovary of the *Styraceæ*, as contradistinguished from that of the *Symplocaceæ*: Dr. A. Gray denies the structure I have assigned to the former in the cases of *Pam-*

philia and *Halesia*; but he is certainly under misapprehension regarding the former genus, as may be seen by reference to Delessert's 'Icones Selectæ' (vol. v. pl. 42), where we find in *Pamphilia styracifolia*, as well as in *Foveolaria ferruginea* (pl. 43), a superior ovary with precisely such a structure as I have described. I shall presently show that the ovary of *Halesia* at an early stage quite conforms to that of *Styrax*, notwithstanding the subsequent difference in the development of the fruit and seed, and that it bears no analogy whatever with that of *Symplocos*.

6. The last objection refers to my definition that in the *Styraceæ* the fruit consists of a unilocular putamen with a single erect seed, in contradistinction to that of *Symplocos*, where a single seed of very different structure is suspended in each of its five cells, and where, by abortion, it is often unilocular: in opposition to which, Dr. Gray shows that in *Halesia* often one, but sometimes three seeds are perfected in as many distinct cells, and that two are matured in *Pterostyrax*. To this I fully assent; but at the same time I shall be able to show that in *Halesia* the remarkable development of its seed results from an ovary exhibiting exactly the same normal structure as that of *Styrax*, and that it offers no analogy whatever with the fruit and seed of the *Symplocaceæ*.

The structure and growth of the ovary and fruit of *Halesia* have been misunderstood equally by Gaertner, Don, Endlicher, and DeCandolle. In *H. tetraptera* the upper moiety of the ovary is quite free, rising in a conical form above the mouth of the calyx, and is completely unilocular within; inside its lower or adnate moiety, at its base, we find a depressed placentary axis connected with the walls of this portion by four very short, thin partitions, so that it is here spuriously four-locellate; and upon the short placentary axis, in each of these divisions, are seen four oblong ovules, two of them superior and standing erect, the others being pendulous within the cavity, all being attached by the short and sharp point of one of their extremities: laterally these ovules are separated by an interval; but vertically the points of attachment of each upper and lower ovule are approximated upon a minute prominence of the placenta. The space above the placenta is completely unilocular, comprising five-sixths of the entire length of the ovary; and the four short basal partitions are seen continuous with as many parietal nervures, that extend thence to the summit, where they are prolonged for some distance into the hollow style. This structure, irrespective of the number of ovules and partitions, agrees precisely with that of *Styrax*, with this difference, that in the latter genus the ovules are inserted upon separate tuberculiform processes emanating from the placenta, while in *Halesia* they are wholly free and attached by a point.

The growth of the ovary in *Styrax* and *Strigilia,* as before mentioned, is confined entirely to the upper portion, while the lower moiety remains of its original length. In *Halesia,* the reverse is observed; for at the same time that the upper moiety continues quite stationary, appearing afterwards like the swollen base of the style, the lower half acquires a gradual increment, until, by the period the fruit is perfected, it attains at least twenty times its former length and breadth. The changes that occur during this growth may be noticed distinctly about a month after the fall of the corolla, by which time the ovary has acquired double its former proportions. On making a section of the ovary at this period, it will be found that, owing to the much greater increment of its basal portion, the placenta, instead of appearing to originate, as formerly, from the very bottom, is now elevated considerably above the base of the central space, and one, two, or three of the incomplete cells are seen raised up with it, and affixed against the inner surface of the main cavity, like parietally suspended sacs, each containing one of its ovules greatly increased in size, with the abortive ones unchanged, while the fourth incomplete cell disappears entirely, so that the ovary now seems completely unilocular from top to bottom, and with one, two, or three ovuligerous open sacs parietally attached to its inner wall.

At the period of four months after the fall of the corolla, I found the ovary increased to ten times its original size; the ovules were in the same parietal position as last described, but their sacs, formerly open, were now enclosed and covered over, one with a bony coating, apparently an extension of the shell of the pericarp, now hardened by osseous deposits; the other cells or sacs, not destined to perfect their ovules, were also entire and enclosed, but the covering here was membranaceous and not ossified. I observed that sometimes two, or all three, of the cells became osseous, and produced perfect seeds. The entire cavity of the main central space, at this period, was filled with a soft white mass of light cellular tissue, which, after two or three days' exposure to the air, when cut open, gradually dried and shrank into a very thin membrane, lining the now hollow cavity of the half-matured fruit. At that period, if only one cellule became osseous, it contained an enlarged ovule, which, though not yet arrived at maturity, clearly exhibited its two distinct integuments, as well as its chalaza, raphe, and embryo; the other two membranaceous cellules contained each a considerably enlarged, though withered ovule, seeming as if it had lost its vitality at some intervening period. Upon the ventral side of these cellules as many distinct longitudinal woody threads are observed, which are the *fila nutritoria* of Mirbel and St. Hilaire, containing the nourishing vessels that originally supplied the placenta, and these are now traceable from the point of attachment of the ovules down to the base of the central vacant space, and into the peduncle.

I have examined the matured seed, in a fresh as well as dried state, and find exactly the same development, only that all the parts are now grown to double the last-mentioned proportions. It commonly occurs here that two osseous cells become perfected, and remain contiguous to one another upon one side of the bony endocarp, each containing a ripe seed; the third cellule is usually obsolete and membranaceous, while, as in the former case, all trace of the fourth cellule disappears: the nourishing threads of the extended placenta are here distinguishable in the position above described. The seeds, in the several instances examined, were either suspended or erect in the respective cells, according to the original position of the ovules from which they were perfected. In *Styrax* the testa is thick and osseous; in *Halesia* it is thin and membranaceous, and often somewhat adherent to the osseous cellule, but it is extracted without difficulty, and, when dry, is of a dark colour, smooth, thin, and of a somewhat chartaceous texture, with a very prominent, adhering, external, simple, cord-like raphe, proceeding from the hilar point of its attachment, and extending along its ventral face to its opposite chalazal extremity, in a line corresponding with the nourishing threads before described, and facing the original axis of the placenta: the inner integument is a delicate transparent membrane that closely invests the albumen; and at its extremity, opposite to that of the hilum, it has a small well-marked chalaza, under the form of a coloured transverse line; at the opposite extremity or radicular end, I have always found a distinct, dark-coloured, free, adpressed thread, which is easily raised by a point; it is a suspensor: the albumen and embryo quite accord with the descriptions of Gaertner and DeCandolle. It may be remarked that the radicular end, with its suspensor, is sometimes superior, at other times inferior, owing to the reason before assigned.

I will add a few words respecting the development of the entire fruit. The calyx, in its young state, has eight prominent external nervures, of which four are opposite to the incomplete cells of the ovary, and terminate in the points of the teeth of the border, the other four alternating with the calycine segments; these last, with the growth of the ovary, acquire a considerable increment, producing, in *Halesia tetraptera*, four long, broad, corticated wings, and in *H. diptera*, only two opposite broad wings, the two alternate ones being much narrower; these wings, in the ripe fruit, are thickened considerably towards the pericarp, and are filled with a soft pith, which extends in a thin layer over the whole of the nut; the latter is indehiscent, fusiform, sharply pointed at both ends, thick, and osseous, with about eight deep grooves. It is justly remarked by DeCandolle, that in the ovary, as well as in the fruit, the cells are placed opposite to the wings, not alternate with them, as figured by Gaertner.

From the above facts it is evident that, in order to comprehend the nature of the structure of the fruit in *Halesia*, it is necessary to trace the progress of the growth of its ovary from its earliest stages to the period of its ultimate development: we thus see how by degrees each ovule is removed from its normal basilar position, and apparently carried up towards the centre, and is afterwards found in a parietal sac attached to the middle of the wall that surrounds a large central vacant space in the growing ovary; but how this open sac extends itself into a completely closed cell, at first membranaceous, and then hardened by thick osseous deposits, I am unable to explain. I can only vouch for the truth of the facts as they are here recorded*.

In regard to the affinities of the *Styraceæ*, I have, in a preceding page, stated my conviction, following the mode of inference adopted by Jussieu, that, from the structure of its ovary, it should hold a position near the *Olacaceæ*, *Humiriaceæ*, and *Meliaceæ*†. Later botanists have lost sight of the true affinities of this order, from having been led away by its supposed connexion with the *Symplocaceæ*,—a misconception which I have endeavoured to rectify. It has from this cause been placed near *Ebenaceæ*, on account of the partial agglutination of its petals and stamens into a tube; but this character ought never to have been thus considered as one of such primary importance, because that union is never perfect; for in *Styraceæ*, even more than in *Symplocaceæ*, those parts may always be separated readily and without laceration. Prof. A. DeCandolle (Prodr. viii. 245), though he admits in some degree its relationship towards *Meliaceæ* and *Humiriaceæ*, yet considers such an affinity to be distant, on account of its ovary being sometimes inferior, also because of the want of a nectary, the different mode of insertion of the corolla, and a dissimilarity in the manner of junction of its monadelphous stamens. But I have shown that in the true *Styraceæ* (excluding the *Symplocaceæ*) the ovary is always wholly superior, or partially superior in those exceptional cases where, by a peculiar mode of growth, it becomes subsequently inferior: this partial immersion of the base of the ovary at an early stage, in *Halesia*, is probably owing to the existence of a disk (the rudiment of a nectary, as in *Humiriaceæ*, or analogous to the disk in *Olacaceæ*), which is here adnate both to it and to the tube of the calyx. In *Olacaceæ* we find in some cases a growth very analogous to that of *Halesia*,—in *Strombosia* for instance, where the calyx, in like manner, is small and inferior, the ovary being surmounted and surrounded by a thick fleshy five-lobed disk which rises from the torus; by the downward growth of the ovary, in a manner similar to that described in *Halesia*, the fruit becomes at length wholly inferior, and crowned by the unchanged toothed margin of the previously inferior, now become superior, and adnate calyx*. In other cases in that family (in *Olax* for example), the calyx enlarges into a tubular form quite free from the fruit which it encloses, as in *Strigilia*. There are many other points of structure which show the evident relationship of the *Styraceæ* to the *Olacaceæ*.

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* A very analogous circumstance is recorded by Mr. R. Brown in the case of *Persoonia* (Linn. Trans. x. 35), where the ovarium is unilocular and contains two ovules; after fecundation, a cellular substance is interposed between them, and this gradually indurating, acquires in the ripe fruit the same consistence as the putamen itself, from whose substance it cannot be distinguished; and thus a cell, originally unilocular, becomes bilocular. The same occurs in *Tribulus*, where each cell of the ovary becomes thus divided into four osseous superposed cellules; and a similar growth takes place in *Bontia*.

† See also my remarks on the affinity of *Styraceæ* with *Olacaceæ*, Ann. Nat. Hist. 2 ser. viii. 163; *huj. op.* p. 23.

Dr. Asa Gray, in his 'Notes on *Vavæa*,' very justly lays great stress upon the affinities of the *Styraceæ* and *Meliaceæ*, and expresses his surprise that this fact had not occurred to me. I had, however, clearly implied it by proposing to place the former order close to the *Olacaceæ* and *Humiriaceæ*, among the *Cionospermeæ*, in which class, if adopted, the *Meliaceæ* would occupy a prominent position; but, notwithstanding all that has been urged by the learned American Professor on this point, to which I readily accede, I still remain of opinion that the proximate alliance of the *Styraceæ* is with the *Olacaceæ* and *Humiriaceæ* rather than with the *Meliaceæ*. In the latter family, the leaves are mostly of considerable length and pinnate; the filaments of the stamens are united into a compact tube, in the mouth of which the anthers are usually quite free and sessile, and where the staminal tube is toothed or lobed, the anthers commonly alternate with the lobes; the seeds, too, are generally arillate, and frequently without albumen, with large fleshy cotyledons, within which the small radicle is retracted: the plants of this family are bitter and astringent,—characters all much at variance with the *Styraceæ*. On the other hand, in *Olacaceæ* and *Humiriaceæ*, the leaves are simple, the stamens quite free, or only laxly agglutinated at base: in the latter family, the filaments are broader and longer than the anther-cells, which are distinct and separated by an interval, and dorsally attached by their whole length to the filament; the seeds are albuminous, with a terete radicle,—characters more in conformity with *Styraceæ*. The juice of *Humirium balsamiferum* has the same smell and balsamic properties as that of *Styrax*, from which it is scarcely distinguishable. The affinity of the *Styraceæ* to the *Humiriaceæ* was distinctly recognized by Prof. Von Martius when he established the latter family*, and was afterwards confirmed by the opinion of Mr. Bentham†. The character which serves more than any other to establish the relationship of the *Styraceæ* with the three families just mentioned, is the imperfect union of the carpels, owing to which the ovary has its dissepiments always more or less incomplete, and therefore it is unilocular in the summit, so that there is never any direct connexion of the placenta with the style. Prof. A. DeCandolle fully admitted this affinity with the *Olacaceæ*, so much so that at one time he proposed to introduce the genus *Liriosma* into the *Styraceæ*‡. In my memoir upon the latter genus§ I pointed out many circumstances in proof of this affinity. I showed that, in a manner analogous to that of *Strombosia*, mentioned in the preceding page, the ovary of *Liriosma* is at first superior, but that, by the expansion of the nectarial disk that supports it, the growth is wholly downwards, so that the fruit becomes completely inferior, as in *Halesia*, crowned by its small unchanged calyx. I noticed also the occurrence of an epigynous gland-like thickening of the ovary, similar to that existing in *Hyoscyamus*||, which forms a prominent feature in *Liriosma* and *Strombosia* and some other genera of the *Olacaceæ*, and occurs sometimes in *Styrax* and generally in *Strigilia*. Dr. Asa Gray does not admit the existence of this epigynous thickening in *Styraceæ*, saying, "It is only the ordinary epidermis of the ovary, with its downy covering, unaffected by the pressure of the base of the corolla and the staminal tube, which closely encircles the lower part, and it readily separates from the rest of the parietes, as it does also in *S. Benzoin*." I will not affirm that it is a distinct formation; but if it be the ordinary epidermis, it certainly assumes a very thickened appearance in *Strigilia*, projecting over the ovary like the eaves of a circular roof, while the lower moiety of the wall of the ovary is attenuated in substance¶. The admission that "it readily separates

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* Blume, Mus. Bot. Lugd. Bat. i. 251. pl. 46.

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* Nov. Gen. et Sp. Bras. ii. 142.

† Kew Journ. Bot. v. 97.

‡ Prodr. viii. 243.

§ Ann. Nat. Hist. 2nd ser. viii. 103, 163; *huj. op.* pp. 16, 23.

|| Ill. S. Amer. Pl. i. 174; ii. App. 9. pl. 79. figs. 8, 9–13.

¶ In *Styrax officinale* I do not find the same disk-like summit of the from the rest of the parietes," seems to favour the idea that it is something more than epidermis, especially when analogy points to the remarkably thick epigynous gland that ordinarily surmounts the ovary in *Olacaceæ*, even when it is entirely superior. The concurrence of so many points of structure in these several families ought to have their due weight in the question of their relative affinities. Prof. DeCandolle *, although he admitted the distant relationship of the *Styraceæ* with the *Meliaceæ*, yet considered that his tribe *Pamphiliæ* was more intimately allied to the latter family than to the former†. Yet the same features that established this identity in his opinion, exist equally in *Strigilia*, though they do not appear to have attracted his attention.

It is difficult to conceive the grounds upon which Prof. Agardh regards the *Styraceæ* (separated from *Symplocaceæ*) as being more immediately allied to the *Elæocarpeæ*, among *Tiliaceæ*‡. By his novel system, the affinities of different families of plants are best demonstrated by the form and mode of development of the ovules. As this character is liable to be modified by many circumstances, it can never retain the importance there attached to it, because if it be employed as a primary mark of distinction, it will often lead to error; but it is nevertheless of considerable value as an accessory feature, which has not hitherto been sufficiently attended to: if, however, we combine with this its essential concomitant, the position and distribution of the placentary portions of the component carpels of the ovary, the affinity in question ceases to be apparent. In his group of the *Elæocarpeæ*, in which he includes the *Tricuspidarieæ* of Endlicher, the union of the component carpels constituting the ovary is complete, and their placentary margins all unite in a solid axis in the centre, the ovules being attached in collateral pairs, in each cell, upon the middle of this axile column. No similar structure exists in *Styraceæ*. In the *Styracineæ*, as I have explained, the numerous ovules, generally in three series, are seated on a central abbreviated column, which has no direct connexion with the style, with the raphe ventral in the erect ovules, superior in the horizontal ones, and dorsal in the lower row, as Prof. Agardh admits: but this seemingly deviating position of the raphe is merely the effect of their resupination on their funicles, produced by mutual pressure during growth; for if each ovule be separately brought into one

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ovary that I have depicted in *Strigilia lævis*; but I notice (as generally throughout the *Styracineæ*) that the lower portion of its wall, which encircles the three-cellular portion of its base, is greatly thinner in substance than its unilocular upper portion, where it is comparatively fleshy.

* Prodr. viii. 215.

† *Ib.* p. 270.

‡ Theor. Syst. Plant. p. 269.

similar angle of radiation from the axis, the raphe in all of them will be seen in the same facial direction. As an example of the different mode of development in *Elæocarpeæ*, I will cite what I have observed in *Aristotelia*: the ovules, two in each cell, are there attached collaterally a little below the summit of the axis; they are naturally at first cupuliform, as Prof. Agardh shows in tab. 21, fig. 7; and in the progress of their growth they probably become, as he says, mutually heterotropal,—that is, one growing upwards, the other downwards, with the raphe towards the axis in both cases. In confirmation of this, I have observed that, at the period of expansion of the flower, the ovules, by the effect of pressure against the cavity of the cell, become twisted round upon their funicles, so as to appear superposed,—the left ovule becoming superior, with its singularly curved chalazal point directed to the dexter side, the right ovule becoming inferior, with its chalazal point turned to the sinister side; and this relative position is retained until they ripen into perfect seeds. I have here spoken only of *Aristotelia*, where the ovules are uniserial, on which account, and on a mistaken notion of a different disposition of the stamens, Prof. Agardh makes this genus the type of a group distinct from *Elæocarpeæ*; but in *Tricuspidaria*, one of his *Elæocarpeæ*, where the ovules are pluriserial as well as collateral, I find that they are all respectively heterotropal,—that is to say, with the raphes, in the one longitudinal row facing those of the other row, all diverging horizontally from the axis. There is no analogy here, in either case, with *Styraceæ*. Moreover, the unguiculate petals in *Elæocarpeæ*, always more or less incised at their summit, the long basifixed anthers opening by bilabiate pores at their apex, the more numerous stamens inserted within a hollow hypogynous disk, upon the outside of which the petals are attached, the dissimilar development of the raphe in the seeds, and very different nature of the seminal tunics, offer other characters completely at variance with *Styracineæ*. I will at some future period publish my analysis of the structures of *Aristotelia*, *Tricuspidaria*, *Dasynema*, and some other genera of the *Elæocarpeæ*, and will here only observe, respecting their seeds, that their seminal tunics are analogous in their nature to those I have described in the *Clusiaceæ* and *Magnoliaceæ**; their outer fleshy coating, bearing a simple raphe, is such as I have termed an arilline, resulting from the growth of the primine†, and quite free and distinct from the hard shell which has been called the testa, and which is probably here developed from the secundine, while the inner tegmen proceeds from the tercine. Prof. Agardh, following Martius and Endlicher, considers *Aristotelia* as the type of a distinct family; but I shall be able to show that it differs little from *Tricuspidaria, Vallœa,* and *Elœocarpus,* and that *Sloanea* and *Dasynema* resemble these in all essential features, if we except their want of petals through abortion. I cannot therefore accord with his opinion concerning *Elœocarpeœ* and *Styraceœ,* that "gemmularum positio et forma, fructus, gemmulæ paucæ evolutæ, et forma embryonis, in utroque ordine fere eadem sunt." Nor can I agree with him concerning the latter family in saying, "certe enim nec cum *Meliaceis,* nec cum *Olacineis* quædam affinitas."

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* Linn. Trans. xxii. 81.

† I was at first led into error in regard to the origin of this outer coating, in opposition to the opinion of Dr. Asa Gray, who, I frankly admit, is perfectly correct in assigning it to the growth of the primine. I then considered it as originating from an expansion of the placentary sheath, which, indeed, it really is; but I confounded this development, from not

The same authority (*l. c.* 270) says of the ovary of *Styrax officinale,* "plusquam dimidia parte calyci adnatum vidi." I find on the contrary, in its complete flower, that the ovary is generally wholly superior; sometimes, however, only a small portion of

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having myself watched the actual mode of growth of the ovule, as explained in a subsequent article (Ann. Nat. Hist. 3 ser. vol. i. p. 358) : my reasoning then would have been correct if the prevailing theory of the inversion of the nucleus upon its centre, owing to the one-sided growth of the coats of an anatropous ovule, as taught in all our elementary books, had not been quite fallacious, as I am since convinced it is. I cannot, however, agree with the distinguished American Professor in considering that the outer fleshy tunic and the hard nut which it covers, in the seed of *Magnolia,* are both derived from one common origin (see *ante,* note, p. 163). Admitting the correctness of the facts, as detailed by that learned botanist, relative to the progress of growth of the ovule of *Magnolia* (Linn. Proc. i. 106), especially in regard to the period of the deposition of sclerogen in the tunic of the ovule, in the manner he relates, it appears to me far more reasonable to conclude that the tunic there described is composed of two integuments (primine and secundine) agglutinated together—the latter becoming solidified subsequently, as he shows—than that we should infer, as he does, that sclerogen is thus copiously deposited upon one half of the cellular tissues of the fleshy mesoderm, to constitute the nut, while the other half of the same tissue retains its lax cellularity—thus forming two seminal coatings of very different nature out of a simple ovular integument (see the former note, p. 163). We have evidence that such an assumed action cannot have occurred, because, in such case, the vessels of the raphe, instead of existing (as they are seen) in the outer fleshy tunic of the seed, ought to have been found imbedded in the inner bony shell, deposited, according to that hypothesis, upon the internal face of the primine, where the vessels of the raphe are always seen attached. I am the more confirmed in this opinion by the instance of *Tricuspidaria,* which offers a strong case of analogy. I have found there, after the ovary has somewhat advanced in growth, subsequent to the fall of the corolla, that the primine becomes thick and fleshy, and remains quite loose over the firm integument that subsequently becomes the nut, being perfectly free from it at all parts of its surface, except at its broad chalazal extremity.

its cavity is below the line of junction of the calyx with the corolla; a solid disk or torus nevertheless supports the ovary, and interposes between it and the summit of the peduncle, the margin of which, adnate to the base of the calyx, sometimes rises a little above the line mentioned, but only in a trifling degree, which is a variable character in the same plant.

Prof. Agardh, again, speaking of my definition of *Styrax*, remarks, "nec ovarium vidi superne uniloculare, nec podospermio cupulato, nec in flore saltem placentam centralem." Now my own observations upon dried specimens of *S. officinale* are completely at variance with the above citation: its ovary appears to me unmistakeably unilocular in the summit, as I have constantly found in *Strigilia*, *Cyrta*, and *Pamphilia*. The fact is confirmed by the definition of the genus in DeCandolle's 'Prodromus' (viii. 259)*; and it is so figured in Delessert's 'Icones' (tab. 42 & 43). In regard to the next point, although I may not have been sufficiently precise in stating that the ovules in the *Styracineæ* are borne upon cup-shaped podosperms, I find there, what is nearly equivalent, that they are almost sessile upon rugose prominences of the placenta, which conceal their micropylar extremity,—the raphe, as above shown, being next the axis in the upper series: these prominences, whether considered as portions of the placenta, or as belonging to the funicles, are precisely analogous to the protuberances he has shown to exist in numerous other cases, where he calls them "telæ conductrices"—as in *Calla*, tab. 2. fig. 10; *Arctostaphylos*, tab. 9. figs. 15 & 16; *Cluytia*, tab. 15. fig. 16; *Hebenstreitia*, tab. 17. fig. 11; *Hedera*, tab. 20. fig. 2; *Erinus*, tab. 28. figs. 1 & 2; and, finally, he shows these very prominences in *Styrax officinale*, tab. 21. fig. 13, which he defines thus: "gemmulas in placenta lobosa magna inter lobos inserta." The central placentation attached to the short incomplete dissepiments cannot be doubted, following as a necessary consequence of the structure above demonstrated.

Prof. Agardh (*l. c.* tab. 22. figs. 16 & 17) confirms my observations upon the direction of the ovules in *Halesia tetraptera*: he also repeats what I have said, that in the ripe seed the chalazal extremity is either superior or inferior, according to whether an erect or pendent ovule has been fertilized; but his view of the structure of the ovary, that the expansion of the placenta divides its space into superior and inferior cells, is not borne out by the facts as they appear to me. He says also, regarding the ovules, "raphe et in adscendente et in pendula extrorsa:" to me, on the contrary, this seemed in both instances directed towards the axis of the ovary, or, perhaps, somewhat lateral to it, and in either case therefore introrse: in this respect they appear to differ from those of the *Styracineæ,* being thus heterotropous, while in the latter tribe, if we regard the fact of their resupination, they are all isotropous. The position I have assigned to the raphe in *Halesia* is moreover proved by its direction in the ripe seed, where it is always turned away from the wall of the nut, and facing the centre of its open space; and this is constantly the same, whether the chalaza be superior or inferior in regard to the apex of the fruit.

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* Prof. A. DeCandolle states, in his generic character of *Styrax* (*l. c.*), solely on the authority of Richard, cited as far back as 1781, that the ovary at its base is adnate to the calyx. Richard probably had confounded the flower of *Halesia*, which is hardly distinguishable from that of *Styrax*, excepting the difference in question.

I have adopted the opinion of Cavanilles in considering *Strigilia* distinct from *Styrax,* with which it has been associated by later botanists; the reasons for this conclusion will be presently stated. The former genus will comprise all the South American species of *Styrax* enumerated by DeCandolle. The Mexican species of the genus, from the imbricate æstivation of their corolla, appear to be congeneric with the North American and European forms.

In looking over the Hookerian herbarium, I noticed two or three species which I had no hesitation in referring to the *Cyrta* of Loureiro,—a genus placed by Endlicher as an aberrant form of the Order, and by DeCandolle excluded from the family solely on account of its superior ovary (Prodr. viii. 245): this reason is untenable, because in the structure of its ovary it offers no difference whatever from *Styrax* and *Strigilia.* I have examined *Cyrta* carefully, and find that it agrees with *Strigilia* in the almost coriaceous texture of its petals and in their valvate æstivation, in which respects both notably differ from *Styrax.*

Owing to the singularly different structure of the fruit and seed in *Halesia* and *Pterostyrax,* it appears desirable to restore the tribe *Halesieæ.* I do not see the propriety of retaining the tribe *Pamphilieæ,* which differs in no respect from the *Styracineæ,* except in having only one or two erect ovules in each placental division: we find in *Styrax Japonica* also two erect ovules in each cellule; so that there is no real character to justify the separation of *Pamphilia* and *Foveolaria* to form a distinct tribe. It is true that the former has only five stamens; but the latter, on the other hand, has the same number as *Strigilia.*

Hence I propose to divide the *Styraceæ* into two tribes, the limits of which may be thus defined:—

Tribus 1. STYRACINEÆ. Ovarium superum, 1-loculare, imo breviter 3-septatum; ovula plurima, erecta aut horizontalia. Fructus drupaceus, omnino superus, 1-locularis, pericarpio indehiscente aut 3-valvari. Semen unicum (rarissime 2), testa ossea, raphide infinitissime diviso in telam cottoneam e vasis numerosissimis spiralibus undique sparsis, et hinc cum endodermide solubili. — Genera *Styrax, Cyrta, Strigilia, Foveolaria, Pamphilia.*

Tribus 2. HALESIEÆ. Ovarium semisuperum, 1-loculare, imo breviter 4–5-septatum. Fructus inferus, alatus, pericarpio nuciformi indehiscente, centro omnino vacuo, locellis 1–2–3 parvis parietalibus osseis 1-spermis. Semen parvum, testa membranacea, raphide simplici ventrali.—Genera *Halesia, Pterostyrax.*

Many other genera have been placed in this family by different authors, all of which (if we except *Cyrta*) have been very properly excluded by Prof. A. DeCandolle in his 'Prodromus' (viii. 245). Among these is *Diclidanthera,* a genus which has lately been amply elucidated by Prof. von Martius in his 'Flora Brasiliensis' (fasc. xvii. p. 11. tab. 4), who, while placing it there among the *Ebenaceæ,* endeavours to show its nearer affinity towards *Polygalaceæ.* It appears to me to hold a different relationship, as I shall shortly demonstrate in a separate paper on this subject.

I will now proceed to offer the characters of each genus of this family in the succession above indicated, mostly derived from my own observations, prefacing each of them by a few remarks.

1. STYRAX.

This genus is distinguished principally by the decided imbrication of its petals in æstivation, in which feature it differs from *Cyrta, Strigilia, Pamphilia,* and *Foveolaria*; its petals are thinner, larger, and more membranaceous in texture than in those genera, and in this respect, and in their æstivation, resemble those of *Halesia* and *Pterostyrax.* In the typical species, *S. officinalis,* the petals often exceed their normal number, five, being sometimes as many as six, seven, or eight. The filaments are longer in proportion to the anthers than in *Strigilia* and *Cyrta*; and in some species the stamens also differ from their normal number, ten, being sometimes as few as six or seven. The endocarp of the fruit is much thicker than in *Strigilia.*

STYRAX, Tournef. Benzoin, *Hayn.* Lithocarpus, *Bl.*— *Calyx* campanulatus, margine fere integro, vix 5-denticulato, persistens. *Petala* 5–6–7–8, oblonga, obtusa, extus tomentella, imo adhæsione filamentorum in tubum brevem conniventia, æstivatione plus minusve imbricata. *Stamina* 10, interdum

abortu pauciora, uniserialia, petalis invicem alterna et opposita, alternis paullo brevioribus; *filamenta* linearia, compressa, cum petalis orta et iisdem imo laxe agglutinata; *antheræ* elongatæ, porrectæ, post dehiscentiam arcuatæ, 2-loculares, loculis parallelis, discretis, dorso per totam longitudinem ad filamentum adnatis, eo dimidio brevioribus, antrorsum rima longitudinali dehiscentibus. *Pollen* reticulatum, depresso-rotundatum, vel sub-3-gonum, angulis vesiculæ hiantibus. *Ovarium* liberum, subovatum, pariete imo tenui et sulcato, summo crassiusculo, intus ad basin sepimentis 3 rudimentariis ad placentam centralem brevem nexis, in carinis totidem parietalibus continuis, et intra stylum cavum percurrentibus, hoc modo superne omnino 1-loculare, et imo brevissime atque incomplete 3-locellatum; *ovula* circiter 9 (interdum pauciora) in quoque locello, crebriter 3-serialia, superiora (cum raphe interna) erecta, media (raphe supera) horizontalia, inferiora resupinatim pendula (cum raphe hinc externa), omnia in tuberculis totidem aut foveolis prominentibus placentæ carnosæ sessa. *Stylus* erectus, valde elongatus, ovario 5–6-plo longior, tenuis, stamina multo superans. *Stigma* obsolete 3-lobum. *Drupa* exsucca, ovato-globosa, tomentosa, calyce brevi immutato suffulta, et stylo persistente terminata, pericarpio coriaceo apice 3-valvatim hiante, 1-locularis, 1- rarissime 2–3-sperma. *Semen* erectum, loculo conforme, impressione carinarum endocarpii 3-sulcatum; *testa* crassiuscula, ossea, nitida, dura, ovulis abortivis circa hilum magnum basalem 277
notata; *raphe* primo tubularis, compressa, ossea, hili basin perforans et mox in faciem internam testæ patescens, hinc breviter ramosa, et cito in filamentis innumerabilibus delicatissimis spiralibus cottoneo-implexis in telam araneiformem ubique producta; *integumentum intermedium* opacum, membranaceum; *integumentum internum* tenuiter membranaceum, ad priorem subadhæsum; *albumen* carnosum; *embryo* axilis, longitudine fere albuminis, *cotyledonibus* foliaceis, rotundato-ovatis, imo subcordatis, nervosis, *radicula* tereti infera duplo longioribus, et 6-plo latioribus.

Arbores *vel* frutices *in Europa, America boreali, Asia et Japonia crescentes, sæpe pilis stellulosis tomentosæ*; folia *alterna, integra, vel dentata, petiolata*; racemi *terminales, pluriflori, foliosi, vel bracteati aut axillares et pauciflori*; flores *albidi.*

Of the forty-five species of *Styrax* enumerated by DeCandolle, I have removed thirty-one into *Strigilia,* and five into *Cyrta*: to the remaining nine (some of which yet remain to be verified) must be added *S. odoratissimum,* Champ. (Hook. Kew Jo. Bot. iv. 304), *S. ellipticum* and *S. subpaniculatum,* Jungh. et Vriese

(Walp. Rep. vi. 459). *S. Obassia,* from Japan, bears greatly the habit and inflorescence of *Pterostyrax*; but, as its fruit is said to be drupaceous, it must be referred to the tribe *Styracineæ*: its broadish rounded petals are much imbricated in æstivation. *S. odoratissimum,* from China, is a very distinct species; its corolla is also imbricated in æstivation, and its drupe is acutely mucronated, with a tendency to split at the base into three regular valves. *S. Benzoin* appears to differ from both in having very entire leaves and a compound raceme. I have not seen its flowers; but its fruit corresponds with that of *S. officinalis.*

2. CYRTA.

I have already alluded to the principal features that distinguish this genus from *Styrax*: its thicker and more ligneous pericarp opens at the apex and splits down to the base in three equal valves; the form of its much thicker petals and the manner of their æstivation are different from those in *Styrax, Halesia,* and *Pterostyrax,* being valvate or slightly introflexed, as in *Strigilia, Pamphilia,* and *Foveolaria.* I have drawn up its generic character from observation upon most of the undermentioned species.

CYRTA, Loureiro.—*Flores* hermaphroditi. *Calyx* urceolato-cyathiformis, margine 5-dentatus, dentibus nervis prominulis decurrentibus hinc 5-carinatus, persistens. *Petala* 5, lineari-oblonga, acuta, crassiuscula, extus tomentella, intus glabra, imo
275 adhæsione filamentorum breviter subconnata, æstivatione valvata, marginibus subinvolutis. *Stamina* 10, uniserialia, erecta, petalis æquilonga; *filamenta* lincaria, angusta, complanata, pilosa, cum petalis orta, et ad eorundem basin breviter et laxe cohærentia, in æstivatione replicata; *antheræ* lineares, 2-lobæ, lobis parallelis ad filamentum angustiorem dorso adnatis et duplo vel triplo brevioribus, sæpe stellatim pilosis, antrorsum longitudinaliter dehiscentibus. *Ovarium* omnino superum, turbinatum, summo depressum, imo 10-sulcatum, calyce quadruplo brevius, tomentosum, 1-loculare, interne carinis 3 prominulis parietalibus e placenta libera brevi centrali orientibus, hinc brevissime pseudo-3-locellatum; *ovula* pauca, e basi erecta, in tuberculis totidem placentæ sessa. *Stylus* simplex, tenuis, glaber, longitudine staminum, summo paullo incrassatus et vacuus. *Stigma* obsolete 3-dentatum. *Drupa* sicca, coriacea, calyce immutato triplo breviori suffulta, turbinata, vel ovata, 1-locularis, 1-sperma, in valvis 3 æqualibus ab apice ad basin hians. *Semen* erectum, solitarium, subglobosum, structura omnino *Styracis,* nisi embryone magis obliquo.

Frutices *Asiatici*; folia *alterna, subintegra aut denticulata, dentibus sæpe glandulosis, petiolata*; racemi *sæpius terminales, foliosi aut bracteati.*

1. *Cyrta agrestis,* Lour. Coch. i. 278;—foliis ellipticis, utrinque acutis, distanter denticulatis, denticulis glandulosis, crassiusculis, glaberrimis, superne nitidis, valde reticulatis, subtus pallidioribus, sub lente venis obsolete stellato-pilosulis, petiolo brevissimo canaliculato; racemis terminalibus, multifloris.—China.—*v. s. in hb. Hook.* (Fortune.)

   Folia 2 poll. longa, 9–11 lin. lata, petiolo vix 1 lin. longo. Racemus 1½–2 poll. longus, 6–8-florus. Calyx urceolatus, sinuato-5-dentatus, 5-carinatus, tomentosus, 2 lin. longus, ore 2 lin. diam. Petala lineari-lanceolata, acuta, 7 lin. long., 1 lin. lat., extus tomentella, intus glabra, parallele nervosa, æstivatione valvata. Stamina 10, quorum 5 petalis alterna et æquilonga, 5 opposita vix breviora, 7 lin. long., filamenta complanata, imo in tubum 1½ lin. long., subcohærentia, et hinc glabra, tunc libera, medio barbata, illinc glabra, connectivo extus stellato-tomentoso; antheræ lineares, dorso adnatæ, 3 lin. longæ. Ovarium oblongum, liberum, imo glabrum, superne pilis creberrimis sericeo-villosum, 1 lin. longum. Stylus tenuis, rectus, glaberrimus, 6 lin. longus; stigma obsoletum; pedicelli 5-angulati, superne crassiores, 4 lin. longi.

2. *Cyrta Finlaysoniana.* Styrax Finlaysonianum, *Wall. Cat.* 4403; *DC. Prodr.* viii. 261;—ramulis racemis calyceque tomentosis; foliis ellipticis, utrinque subobtusis, margine crenulatis, fere integris, superne viridibus, glaberrimis (junioribus tomentellis), nervis parum eminentibus, venis transversis reticulatis, subtus pallidis, sparse et obsolete stellato-pilosis; racemis paucifloris, simplicibus, quam folium dimidio brevioribus, floribus stramineo-tomentellis, pedicellis calyce sub-brevioribus, calyce subhemisphærico, 5-denticulato.—India Orient.—*v. s. in hb. Wall.*

   Folia 3–4¼ poll. longa, 1½–2 poll. lata, petiolus 3 lin. longus; racemi in ramulis imo foliosis terminales, circiter 6-flori.

3. *Cyrta luculenta.* Cyrta agrestis, *Ham., non Lour.* Styrax serrulatum, *Wall. var. β*;—foliis ovalibus vel ellipticis, utrinque acutis, glaberrimis, irregulariter denticulatis, dentibus glandulosis, superne fusco-viridibus nervis stramineis, inferne interdum pallidioribus, nervis venisque transversis prominentibus, in areolis (rudimento pilorum) punctulatis, petiolo tenui canaliculato, subtus tomentoso; racemis terminalibus et axillaribus floribusque pallide tomentellis.—Assam.—*v. s. in hb. Hook.* (Griffith, 286.)

   Species valde distincta: folia 2½–4½ poll. longa, 14–16 lin.

lata, petiolus 2–3 lin. longus; racemus 2–2½ poll. longus, 6–8-florus; fructus ovatus, calyce cupuliformi suffultus, tomentosus, 5 lin. longus, 4 lin. diam., styli vestigio apiculatus, pericarpio crasso lignoso e basi trivalvatim rimante, abortu monospermus.

4. *Cyrta Japonica.* Styrax Japonica, *Sieb. & Zuccar. Fl. Jap.* i. 53. tab. 23; *DC. Prodr.* viii. 266.—Japonia.

5. *Cyrta dealbata,* n. sp.;—foliis oblongis, acuminatis, imo obtusis, crassiusculis, subintegris, margine irregulariter crenulato-recurvo, superne glaberrimis, nervis rachique sulcato-impressis, subtus cano-pruinosis, nervis venisque transversis reticulatis prominulis, petiolo tereti, canaliculato, tomentoso; racemis multifloris, axillaribus et terminalibus, stramineo-albidis, pruinoso-tomentellis, calyce hemisphærico, fere integro, petalis 5, linearibus, acutis.—Malacca.—*v. s. in hb. Hook.* (Griffith.)

Folia 2½–3 poll. longa, 1¼–1½ poll. lata, petiolus 4 lin. longus; racemus 1¾ poll. longus; flores parvi, vix 5 lin. longi; calyx 1½ lin. longus; petala crassiuscula, linearia, intus fusca, glabra, parallele nervosa, vix linea lata, æstivatione valvata, demum reflexa.

6. *Cyrta suberifolia.* Styrax suberifolium, *Hook. & Arn., Beechey Voy.* 196, tab. 40; *DC. Prodr.* viii. 261; *Hook. Jo. Bot.* iv. 304.—Ad char. opt. in DC. Prodr. adde: fructu ovato, avellani magnitudine, in valvibus 3 ab apice ad basin hiante, semine
281 subgloboso.—China.—*v. s. in hb. Hook.* Hong-Kong (*Champion*).

Fructus subsphæricus, 6 lin. diam., calyce persistente suffultus.

7. *Cyrta virgata.* Styrax virgatum, *Wall.*; *DC. Prodr.* viii. 267. —India orient.—*v. s. in hb. Wall.* (*Cat.* 4400), Sylhet.—*in hb. Hook.* Khasya (*Griffith, Lobb*).—Bootan (*Griffith,* 2268).

8. *Cyrta serrulata.* Styrax serrulatum, *Roxb. Flor. Ind.* iii. 415; *DC. Prodr.* viii. 267 (excl. synon.).—India orient.—*v. s. in hb. Wall.* (*Cat.* 4400 B.)—*in hb. Hook.* Garhutty (*Simon,* 66).

Species præcedenti valde similis; in utraque, folia valde pallida, glabra, textura tenui, in *C. serrulata* apice longiuscule acuminata, dentibus magis perspicuis glandula tereti elongatis.

3. STRIGILIA.

In a preceding page my reasons are given for separating this genus from *Styrax.* The well-marked differences in character are quite in accordance with the geographical distribution of the species, which are all confined to the tropical parts of the South

American continent, both on the western and eastern sides. It differs from *Styrax* in its more fleshy, almost coriaceous, and narrower petals, which are always acuminated and valvate in æstivation. The stamens are nearly the length of the petals; and the anther-lobes, which are parallel and linear, are attached by their entire length upon the filament, which exceeds them in breadth and around their apex; they are separated from one another by a narrow interval, and are only in a small degree shorter than the filaments, which hence appear extremely abbreviated, and which below the lobes are covered by a tuft of long, stiff, spreading hairs: the margins of the filaments are very laxly coherent, and loosely attached, for a very short interval, to the base of the petals. The fruit is oblong, sub-baccate, half enveloped by the free persistent calyx; the endocarp is easily separated from the rest of the thin indehiscent pericarp, and is thin, polished, and horny, and easily sectile into three valves, which are marked in the manner before described. Its testa is not so thick as in *Styrax* and *Cyrta*, and its embryo is longer and more erect. It agrees with *Cyrta* in the form and æstivation of its petals, but differs in its much longer anthers and in its indehiscent pericarp.

Strigilia, Cav. Foveolaria *in parte, R. & P.* Tremanthus, *Pers.* Epigenia, *Vell.* Styrax *in parte, A. DeCand. et aliorum.*—*Flores* hermaphroditi. *Calyx* tubulosus, obconicus, 5-carinatus, margine obsolete 5-denticulatus, demum paullo accrescens, omnino liber, persistens, et fructum laxe cingens. *Petala* 5, lineari-oblonga, crassiuscula, tomentosa, æstivatione valvata, cum staminibus imo laxe cohærentia, hinc pseudo- 281 gamopetala, decidua. *Stamina* 10, uniserialia, cum petalis inserta, quorum 5 paullo longiora, petalis subbreviora et alternantia, 5 reliqua petalis opposita; *filamenta* linearia, complanata, antheris sæpissime latiora, stellato-pilosa, imo pilis simplicibus longis crebris barbata; *antheræ* 2-lobæ, longitudine fere filamentorum, lobis linearibus, segregatis, parallelis, dorso omnino adnatis, tenuiter membranaceis, sæpissime stellato-pilosis, rima antica longitudinaliter dehiscentibus. *Pollen* sub-3-gonum. *Ovarium* superum, rarius principio in torum paullulo immersum, cito emersum et omnino liberum, staminibus dimidio brevius, subturbinatum, imo sub-5-gonum, sæpissime apice depresso-conico 5-sulcato umbraculiformi incrassatum, summo omnino 1-loculare, imo plus minusve breviter 3-septato, septis in nervis 3 carinatis parietalibus intra stylum cavum percurrentibus, ad basin cum placentam centralem abbreviatam annexis et hinc locellos 3 incompletos mentientibus; *ovula* plurima, crebra, 6–10 in quoque locello, 2–3-serialia, in tuberculis totidem placentæ imo immersa, in-

terdum (placenta brevissima) omnia erecta, vel (ista longiore) superiora erecta, intermedia horizontalia, inferiora resupinatione pendula, raphe ut in *Styrace* manifesta. *Stylus* erectus, imo crassior, et hinc cavus, stamina vix excedens. *Stigma* inconspicuum, brevissime 3-lobum, lobis divaricatis. *Drupa* subcarnosa, ovalis, calyce cupuliformi persistente semi-involuta, mesocarpio parco, carnoso, endocarpio tenuiter corneo, utrinque nitente, maculato, indehiscente, sed in valvis 3 facile sectili, valvis carina interna mediana signatis, 1-locularis, monosperma. *Semen* erectum, loculo conforme, carinis endocarpii 3-sulcatum, placenta persistente basali paullo lateraliter excentrica ovulis abortivis cincta suffultum, *hilo* majusculo signatum; *testa* ossea, fragilis, nitida, endodermide separabili, propter *raphen* hilum perforantem mox in vittas numerosas divisam e filis delicatissimis spiralibus numerosissimis compositas et in telam araneiformem ubique productam; *integumentum intermedium* submembranaceum, ad endodermidem solubilem agglutinatum; *integumentum internum* altero liberum, tenuissimum, cum albumine cohærens; *embryo* fere verticalis, *albumine* carnoso opalino paullo longiore inclusus, *cotyledonibus* ovatis, foliaceis, nervosis, *radicula* tereti infera duplo longioribus et 6-plo latioribus.

Arbores *Americæ tropicæ, sæpissime pilis stellatis tomentosæ;* folia *alterna, integerrima, crassiuscula, sæpius subtus argenteo-vel ochraceo tomentosa, valde reticulata, rarius glabra ;* racemi *axillares, vel ramulos terminantes,* pedicellis *bracteatis, 1-floris ;* flores *tomentosi.*

The species hitherto recorded are :—

1. *Strigilia oblonga,* DC. Prodr. i. 621. Styrax oblongum, *A. DC. Prodr.* viii. 261.—Peruvia, ad Chinchao et Pillao.
2. *Strigilia Guayanensis.* Styrax Guayanense, *A. DC. loc. cit.*—Guiana Britannica (*Schomb.* 965 *vel* 596).—Rio Amazon (*Spruce*).
3. *Strigilia pallida.* Styrax pallidum, *A. DC. l. c.*— Guiana Gallica (*Le Prieur,* 272).
4. *Strigilia acuminata.* Styrax acuminatum, *Pohl, Bras.* ii. 58. tab. 138; *A. DC. l. c.* p. 262.—Brasilia (Rio de Janeiro et Santa Catharina).
5. *Strigilia latifolia.* Styrax latifolium, *Pohl, l. c.* 60. tab. 140; *A. DC. l. c.* 262.—Brasilia (Prov. Minas Geraës).
6. *Strigilia camporum.* Styrax camporum, *Pohl, l. c.* 56. tab. 136; *A. DC. l. c.* 262.—Brasilia (Prov. Minas Geraës).
7. *Strigilia parvifolia.* Styrax parvifolium, *Pohl, l. c.* 53. tab. 133; *A. DC. l. c.* 262.—Brasilia (Prov. Minas Geraës).

8. *Strigilia subcordata.* Styrax subcordatum, *Moricand, A. DC. l. c.* 262.—Brasilia (Bahia).
9. *Strigilia alba.* Styrax album, *Spreng. Syst.* ii. 285; *A. DC. l. c.* 263.—Brasilia (Prov. Minas Geraës).
10. *Strigilia reticulata.* Styrax reticulatum, *Mart. Reis.* ii. 551; *A. DC. l. c.* 263.—Brasilia (Prov. Minas Geraës).
11. *Strigilia Gardneriana.* Styrax Gardnerianum, *A. DC. l. c.* 263.—Brasilia (Prov. Piauhy. *Gardn.* 1924).
12. *Strigilia florida.* Styrax floridum, *Pohl, l. c.* ii. 54. tab. 134; *A. DC. l. c.* 263.—Brasilia (Prov. Goyaz).
13. *Strigilia obliquinervia.* Styrax obliquinervium, *A. DC. l. c.* 263.—Brasilia (Prov. Minas Geraës. *Claussen,* 306).
14. *Strigilia nervosa.* Styrax nervosum, *A. DC. l. c.* 263.—Brasilia (Prov. Minas Geraës. *Claussen,* 303).
15. *Strigilia chrysastera.* Styrax chrysasterum, *Pohl, l. c.* ii. 59. tab. 139; *A. DC. l. c.* 264.—Brasilia (Prov. Goyaz).
16. *Strigilia Pohlii.* Styrax Pohlii, *A. DC. l. c.* 264. S. ferrugineum, *Pohl* (*non Nees & Mart.*) *l. c.* ii. 55. tab. 135.—Brasilia (Prov. Minas Geraës et S. Paölo).
17. *Strigilia longiflora.* Styrax longiflorum, *A. DC. l. c.* 264.—Brasilia (Prov. Bahia. *Blanchet,* 3458).
18. *Strigilia punctata.* Styrax punctatum, *A. DC. l. c.* 264.—Brasilia (Prov. Piauhy. *Gardn.* 2912).
19. *Strigilia aurea.* Styrax aureum, *Mart. Reis.* ii. 551; *A. DC. l. c.* 264.—Brasilia (Prov. Minas Geraës).
20. *Strigilia argentea.* Styrax argenteum, *Presl, Rel. Haenk.* ii. 61; *A. DC. l. c.* 264.—Mexico (Acapulco).
21. *Strigilia racemosa,* Cav. Diss. vii. 338, tab. 201. Styrax racemosum, *A. DC. l. c.* 265.—Peruvia.
22. *Strigilia ferruginea.* Styrax ferrugineum, *Nees & Mart. Nov. Act.* xi. 88; *A. DC. l. c.* 265.—Brasilia (Prov. Minas Geraës). 2 5
23. *Strigilia tomentosa.* Styrax tomentosum, *Bonpl. Pl. Æquin.* ii. 72. tab. 101; *H. B. K.* iii. 261; *A. DC. l. c.* 265.—Quito.
24. *Strigilia pauciflora.* Styrax pauciflorum, *A. DC. l. c.* 265.—Brasilia (Prov. Bahia. *Blanchet,* 1719).
25. *Strigilia ovata,* DC. Prodr. i. 621. Foveolaria ovata, *R. & P. Syst.* i. 100. Tremanthus ovatus, *Pers. Ench.* i. 467. Styrax ovatum, *A. DC. l. c.* 267.—Peruvia.
26. *Strigilia cordata,* DC. *l. c.* i. 621. Foveolaria cordata, *R. & P. Syst.* i. 99. Tremanthus cordatus, *Pers. Ench.* i. 467. Styrax cordatum, *A. DC. l. c.* 267.—Peruvia.
27. *Strigilia leprosa.* Styrax leprosum, *Hook. & Arn. Jo. Bot.* i. 282; *A. DC. l. c.* 268.—Brasilia (Prov. Rio Grande do Sul).
28. *Strigilia macrophylla.* Styrax macrophyllum, *Schott, Spr. Syst.* iv. 425; *A. DC. l. c.* 268; *Pohl, l. c.* ii. 61. tab. 141.—Brasilia.

Species glabræ.

29. *Strigilia glabrata.* Styrax glabratum, *Spreng. Syst.* iv. *Cur. post.* 406; *A. DC. l. c.* 266. Styrax eremophyllum, *Pohl. l. c.* 57. tab. 137. Epigenia integerrima, *Vell. Flor. Flum.* p. 183; *Ic.* iv. 137.—Brasilia (Prov. Rio de Janeiro).
30. *Strigilia Pavonii.* Styrax Pavonii, *A.DC. l.c.* 266.—Peruvia.
31. *Strigilia psilophylla.* Styrax psilophyllum, *A. DC. l. c.* 266. —Guiana Gallica.

32. *Strigilia leiophylla.* Styrax leiophyllum, *Nob. in Lindl. Veg. Kingd.* 593 *cum icone*;—foliis elliptico-oblongis, basi apiceque subacutis, acumine obtusiusculo, utrinque glaberrimis, in junioribus pilis raris stellatis sparsim donatis, superne lucidis, subtus læte viridibus, subtenuibus, costa media nervisque stramineis subprominulis superne immersis, transversim reticulato-venosis, integerrimis, margine tenui cartilagineo haud revoluto, petiolo sparse pilosulo, superne canaliculato; racemis axillaribus, petiolo 2–3-plo longioribus, 6–12-floris; pedicellis lepidotis, profunde 5-sulcatis, cum flore subæquilongis; floribus lepidoto-pruinosis; bacca ovali, calyce libero cupuliformi semi-inclusa.—Brasilia (in Montibus Organensibus, Prov. Rio de Janeiro). *v. v.*

Species mihi lecta, in fructu (Freixal), in flore (Valença); *S. glabratæ* cognata, tamen sat distincta, sed ita discrepat; folia plusquam dimidio longiora et fere 3-plo latiora, tenuicula, non coriacea, nullo modo pilosa; racemi 2-plo majores, pluriflori. Ramuli juniores lepidoti; folia 4–5 poll. longa, 2–2½ poll. lata, utrinque glaberrima, lucida; petiolus 6–8 lin. longus, lepidotus, canaliculatus; racemi axillares, simplices, 1½–2 poll. longi, 254 6–12-flori, pedicelli angulati, 4–5 lin. longi (in fructu 7 lin.), apice incrassati, calyceque granuloso-lepidoti, flavescentes; calyx tubulosus, 2½ lin. longus, 2 lin. diam., margine fere integro, vix 5-denticulato, corollam arcte cingens. Corolla extus albida aut flavescens, lepidoto-pruinosa, in alabastro 5-angulata, æstivatione valvata; petala 5, linearia, 10 lin. longa, 1 lin. lata, intus callo apicali marginibusque tomentosis, medio glabra, parallele nervosa, crassiuscula; stamina 10, petalis breviora, filamenta 7 lin. longa, cum petalis orta, iisque imo laxe conglutinata, complanata, tenuia, linearia, antheris latiora, glabra, sed infra antheras fasciculo denso pilorum barbata; antheræ 3½ lin. longæ, lobis sejunctis, parallelis, filamento omnino adnatis, pelliculares, sparse stellato-pilosæ. Ovarium depressum, apice subconico vel umbraculiforme 5-sulcatum, 1 lin. diam., albido-pruinosum, imo constrictum et hinc glabrum. Stylus tenuis, glaber, 9 lin. longus. Stigma sub-

obsoletum. Bacca oblonga, flavido-viridis, glauco-pruinosa, 3 lin. longa, 4 lin. diam.*

The *Strigilia australis*, Juss., is *Pennantia Cunninghami*, Nob. (Ann. Nat. Hist. ser. 2. ix. 491).

4. Pamphilia.

This genus scarcely differs from *Strigilia*, the principal point of distinction being the suppression of one-half of its stamens, which are only five in number, and alternate with the petals; they are only two-thirds the length of the petals, and the anthers are one-third the length of the filaments: these last are membranaceous, broad, nearly double the breadth of the adnate anther-cells, forming an expanded thin border round the sides and apex of the anthers. The anthers are sometimes deficient of pollen, in which case they cohere slightly by their margins into a tube, from the bottom of the anthers to the base; but when polliniferous, they are distinct and free, a character of frequent occurrence in *Strigilia*: they are glabrous, except along a dorsal median nerve, which is stellately pilose. The ovary is depressed and turbinate, corresponding in its internal structure with that of *Strigilia* in all respects, except that it has only a single erect ovule in each pseudo-cell. The fruit I have not seen, nor does it appear to be yet known. The following amended generic character is founded upon my own observations:—

Pamphilia, Mart.—*Flores* hermaphroditi aut subpolygami. *Calyx* campanulatus, crasso-coriaceus, extus dense tomentosus, margine 5-denticulatus. *Petala* 5, oblonga, crassa, tomento stellato dense velutina, apice inflexa, æstivatione valvata, imo adhæsione staminum breviter connata. *Stamina* 5, hypogyna, petalis alterna et paullo breviora; *filamenta* latissima, complanata, membranacea, antheris duplo longiora et latiora, glabra, imo plus minusve breviter sese et cum petalis laxe adhærentia, apice obtusa et retusa; *antheræ* oblongæ, dorso ad filamenta adnatæ, 2-lobæ, lobis linearibus parallelis paullo segregatis, rima longitudinali antice dehiscentibus, valvis membranaceis, glabris; (*stamina sterilia* fertilibus omnino similia, sed infra antheras in tubum cohærentia, tubo cum petalis laxe agglutinato, antherarum locellis vacuis). *Pollen* ovatum, 3-sulcatum, reticulatum. *Ovarium* depresso-turbinatum, albido-tomentosum, calyce tertio brevius, superne 1-loculare, imo pseudo-3-loculare, septis cum nervis totidem parietalibus continuis; *ovula* 3, e basi erecta, in locellis solitaria. *Stylus* teres, longitudine staminum, erectus, glaber. *Stigma* obsolete 3-lobum. *Fructus* ignotus.

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* The structure of the seed is fully described in a preceding page (p. 161). A drawing of this species, with analytical details, is given in plate 30.

Arbusculæ *Brasilienses ramulis, foliis subtus, racemis calycibusque pilis fasciculatis rubiginoso-tomentosæ*; folia *alterna, elliptica, coriacea, integra, subtus tomentosa, nervis venisque reticulatis valde prominentibus, juniora superne pubescentia, adulta glabra*; racemi *simplices, axillares, foliis sub-breviores,* pedicellis *alternis, calyce brevioribus*; flores *parvi*; petala *externe albido-tomentella, intus glabra.*

1. *Pamphilia aurea,* A. DC. Prodr. viii. 271.—Brasilia (Prov. Minas Geraës. *Claussen,* 184).

2. *Pamphilia styracifolia,* A. DC. *loc. cit.* 271; Delessert, Icon. Sel. v. 18. tab. 42.—Brasilia (Prov. Minas Geraës. *Claussen,* 135; *Gardner,* 4994).—*v. s.*

I have two specimens of the latter species, one collected by Claussen, the other by Gardner: in the latter the anther-cells are entirely void of pollen, and the filaments below them are united into a monadelphous tube: in Claussen's specimen the filaments are distinct, and free nearly to the base, as shown in Delessert's excellent representation; the anthers are polliniferous. The ovary is ovuligerous, as in Gardner's plant. It is therefore most probable that in *P. aurea* the union of the filaments for nearly their whole length, as described by Prof. DeCandolle, is a sexual, not a general character.

5. Foveolaria.

This genus was established by Ruiz and Pavon upon five Peruvian species: of these, Prof. A. DeCandolle rejects four, which he refers to *Styrax* (*Strigilia*), retaining only *F. ferruginea*; of the latter, an excellent figure is given in Delessert's 'Icones Selectæ,' v. tab. 43, the detailed analysis of which, and the description in the 'Prodromus,' constitute all the knowledge we have concerning it. As I have never seen a specimen, I cannot form a decided opinion of the validity of the genus. Like *Pamphilia,* it is distinguishable from *Strigilia* in its ovary having only a solitary erect ovule in each pseudo-cell; but it differs again from *Pamphilia* in having, like *Strigilia,* 10 stamens. Its chief differential character, that of its monadelphous stamens, as I have suggested in *Pamphilia,* is probably only a sexual feature, and not more than a lax agglutination of the margins of the filaments: that of its free ovary is common to *Strigilia* and all the genera of the *Styracineæ.* It resembles *Pamphilia* greatly in habit, and appears to differ from it and *Strigilia* only in the characters above mentioned. If, therefore, its ovules be sometimes more than one in each division, as Prof. DeCandolle suspects, there would not then remain a single feature to distinguish the genus from *Strigilia.*

From the materials above cited I have drawn up its generic character as follows:—

FOVEOLARIA, R. & P. Tremanthus, *Pers.*—*Flores* subpolygami. *Calyx* campanulatus, crasso-coriaceus, extus densiter tomentosus, margine 5-denticulatus. *Petala* 5, oblonga, crassa, calyce 2-plo longiora, extus tomentosa, imo (adhæsione staminum) breviter connata, æstivatione valvata, apice inflexa. *Stamina* 10, uniserialia; *filamenta* lata, membranacea, antheris sesquilonga, dorso pubescentia, imo sese et cum petalis laxe in tubum connata; *antheræ* lineari-oblongæ, dorso ad filamenta adnatæ, 2-lobæ, lobis linearibus, parallelis, distinctis, rima longitudinali dehiscentibus. *Ovarium* ovoideum, sericeum, superne 1-loculare, imo brevissime pseudo-3-locellatum, septis cum nervis totidem parietalibus continuis; *ovula* in quoque locello 1 (vel interdum 2) e basi erecta. *Stylus* cum ovario continuus, gradatim attenuatus, pilosulus, longitudine staminum. *Stigma* breviter 3-lobum. *Bacca* ovoidea, calyce suffulta, 1-locularis. *Semina* 1 vel 2, imo ovulis sterilibus notata, structura *Strigiliæ.*

Frutex *elatus, Peruvianus, ramis racemis calycibus foliisque subtus ferrugineo-tomentosis, pilis fasciculatis*; folia *alterna, oblongo-elliptica, integra, utrinque obtusa, coriacea, superne glabra*; racemi *axillares, simplices, foliis duplo longiores*; pedicelli *alterni, calyce breviores*; flores *parvi.*

1. *Foveolaria ferruginea,* R. & P. Syst. 100; DC. Prodr. viii. 272; Deless. Icon. Sel. v. 19. tab. 43. Tremanthus ferrugineus, *Pers. Ench.* i. 467. Strigilia racemosa, *DC. Prodr.* i. 621 (*non Cav.*).—Peruvia.

6. HALESIA.

I have already given full details of the structure of the ovary in this genus, of the curious mode of development of its ovules, and the growth of its fruit and seed, all of which show clearly, notwithstanding these anomalous appearances, that it belongs truly to *Styraceæ.* In habit, the species bear great external resemblance to those of *Styrax*; the petals are of the same form, colour, and size, the æstivation of the corolla is similar, and in their stamens there is a remarkable resemblance: but the flowers are not racemose, as in that genus; on the contrary, they grow upon slender, drooping, solitary peduncles, which are few, and fasciculated at the ends of the terminal branchlets, appearing in the axils of the fallen leaves of the previous year's growth, before the new leaves sprout, so that the branchlets then bear the semblance of racemes; but before the fall of the corolla, other young branchlets grow out of the axils with great rapidity, to a considerable length, producing fresh leaves in abundance, which completely destroy the racemose appearance of the branchlets. The peduncles are longer than the flowers, which resemble those of *Styrax officinalis.* In their structure the anthers quite conform to those of *Styrax* and *Strigilia,* the two parallel linear lobes being separated by a considerable interval, quite adnate for their entire length upon a more or less broad ligular filament, very thin and membranous in texture, and bursting inwardly by a longitudinal fissure: the filaments continue broad and compressed to their base, where they are laxly connate for a short distance, and at the same time they slightly agglutinate together the bottom of the claws of the petals—all being easily separated without any laceration of the parts; indeed before the flower fades they become detached from one another of their own accord; it is therefore incorrect to describe the corolla as monopetalous, and the stamens as monadelphous. I have observed that in *H. tetraptera* the style is simple throughout its entire length; but in *H. diptera* it most frequently (but not always) divides into three distinct thread-like portions for a considerable distance from the summit. There is generally much symmetry in the number of its parts: in *H. tetraptera* the calyx is 4-toothed, the petals four in number, and the stamens eight or twelve; in *H. diptera* the same numbers prevail, the stamens not exceeding eight; but in the latter species there are sometimes five teeth in the calyx, and in such case there are five, rarely six petals, and the number of stamens is diminished to seven or six; but these are probably only exceptional occurrences. The style is conical and hollow at its base for about a quarter of its length upwards, the three or four parietal nervures continued from the inner surface of the ovary extending along the sides of this hollow cavity. The structure of the ovary, and the singular mode of its development and growth, have been minutely described in a preceding page (167). From these observations, which are in great part novel, I have drawn up the following character of the genus.

HALESIA, Ellis.—*Flores* hermaphroditi. *Calyx* parvus, turbinatus, ovario adnatus, margine libero hinc breviter 4–5-denticulatus, dentibus acutis, erectis, nervis medianis cum carinis totidem decurrentibus continuis. *Petala* 4–5, dentibus caly-

cinis alterna, ampla, lata, cuneato-oblonga, tenuiter membranacea, adhæsione staminum imo brevissime agglutinata, æstivatione valde imbricata. *Stamina* 8 vel 12, sæpe 10, uniseriata, subæqualia, petalis paullo breviora; *filamenta* compressa, loriformia, imo cum petalis laxe agglutinata, interdum libera; *antheræ* introrsæ, summis filamentorum omnino adnatæ, et iis 5-plo breviores, 2-lobæ, lobis discretis, parallelis, linearibus, rima longitudinali dehiscentibus. *Pollen* 3-gonum, angulis bulla signatum. *Ovarium* turbinatum, semisuperum, dimidium inferius calyci adnatum, hinc post anthesin cito elongatum et valde auctum; dimidium superius non augescens, hinc conicum, liberum, stylo continuum, immutatum, et fructu coronante persistens; 1-loculare, imo septulis 4–5 brevibus radiantibus ad placentam centralem e basi ortam nexis, et cum carinis totidem internis prominulis parietalibus intra stylum percurrentibus continuis, hoc modo breviter 4–5-locellatum, locellis superne apertis et lobis calycinis oppositis: *ovula* oblonga, 4 ad 8 in quoque locello, ad placentam biseriatim funiculis brevibus affixa, superiora erecta, inferiora pendula, fere omnia abortientia; (exinde prolatione fundi ovarii obtingit ut locelli spurii 3 (unico evanido) jampridem basilares, mox parietales eveniunt; isti in principio aperti, dein membrana clausi, sæpe cum pericarpio osseo indurescant). *Stylus* filiformis, imo incrassatus et cavus, stamina paullo superans, integer, aut apice 3-fidus. *Stigma* simplex, fere obsoletum. *Fructus* oblongus, siccus, indehiscens, apice summo persistente ovarii coronatus, 2–4-alatus, alis amplis, æqualibus, vel alternatim minoribus, e nervis calycinis oriundis. *Nux* ossea, fusiformis, 8-sulcata, centro 1-locularis, parieti interno (e locellis modo supradicto translatis et clausis) 1–3-locellata, locellis monospermis. *Semen* erectum vel suspensum, exarillatum, cylindricum; *funiculus* brevis; *testa* cuticularis, ad pericarpium laxe adhærens, *raphide* simplici sublaterali notata; *integumentum internum* tenuissimum, versus hilum filamento brevi donatum, et ad alteram extremitatem *chalaza* lineari transversali signatum. *Embryo* in *albuminem* carnosum parcum paullulo longiorem inclusus, subteres; *radicula* teres, *cotyledonibus* vix latioribus linearibus fere æquilonga.

Frutices *Americæ septentrionalis, aspectu* Styracis; folia *alterna, ovata, acuta, integra vel glanduloso-denticulata, decidua*; flores *laterales, ex axillis annotinis aphyllis orti, solitarii, vel sæpius terni, fasciculati, pilis stellatis tomentosi,* pedicellis *elongatis, nutantibus.*

1. *Halesia tetraptera,* Ellis, Phil. Trans. li. p. 931. tab. 22;

Linn. Sp. 636; Cav. Diss. vi. p. 338. tab. 186; Gaertner, Fruct. i. 160. tab. 32. fig. 2; Bot. Mag. tab. 910; Lam. Ill. t. 404; Mich. Fl. Bor. ii. p. 40; Pursh, Fl. N. Amer. ii. p. 449; Lod. Bot. Cab. t. 1173; A. DC. Prodr. viii. p. 269;—ramulis subangulatis, cortice in fibrillis solubili; foliis ellipticis, acuminatis, serrulatis, dentibus glandulosis, membranaceis, reticulatis, junioribus pubescentibus, adultis fere glabris, costa nervis venisque molliter subpilosulis, læte viridibus, subtus pallidioribus, nervis stramineis ibi prominulis, petiolo subtenui, tereti, canaliculato, puberulo; floribus 3–4-fasciculatis, ex axillis aphyllis annotinis, cum pedicellis articulatis; pedicello flori æquilongo, nutante, tomentoso; calycis tubo glabro, dentibus obtusiusculis, pubescentibus; petalis late obovatis, glabris; staminibus 12, filamentis late membranaceis, demum canaliculatis, molliter puberulis, imo cum petalis brevissime agglutinatis; stylo glabro, staminibus longiore, stigmate fere obsoleto; fructu 4-ptero.—In Carolina, Georgia, et Florida. —*v. v. in hort. Kew.*

The above diagnosis, differing in some respects from that given by Prof. DeCandolle, is drawn from my own observation upon a tree that has been growing in Kew Gardens from the time of Aiton. The leaves are $4\frac{1}{2}$–$5\frac{1}{2}$ inches long, 2–$2\frac{3}{4}$ inches broad, upon a petiole 6 lines in length. The peduncles are from 4–6 lines long. The calyx here is distinctly articulated upon the peduncle, and is always glabrous, though its teeth and the peduncle are tomentose, while, I believe, in the American specimens the calyx is wholly tomentose, as described in the 'Prodromus;' the whole flower is indeed only half the size of those in specimens from the United States, so that we may infer that it constitutes perhaps a distinct variety. The petals here are 6 lines long and 4 lines broad, narrowing gradually to the base into a claw, and are quite glabrous; in native specimens they are sparsely clothed on both sides with stellated hairs, and in the bud tomentose externally. The stamens are 4 lines long, the anthers 1 line, the cells linear, parallel, and separated by a distinct interval; each filament is perfectly glabrous, tubularly hollow, sub-4-gonous, and marked by a nervure along its back; the termination of this tube is fleshy, forming a roundish linear connective, upon which the anther-cells are dorsally adnate for their entire length. In the American specimens the stamens are 6 lines long, the anther-cells being 2 lines in length; but then the filaments are much broader, consisting of a thin simple membrane with a central nervure, and they are sparsely stellately pilose; those in the bud appear to adhere together by their margins for their whole length, but on the opening of the petals they separate from one another almost to the base, and even there they are detachable by a slight force. The style is 7 lines long, slender, continuous with the free conical summit of the ovary, and, like it, perfectly glabrous; in the American specimens the style is pubescent. The internal structure of the ovary has been fully described; the placenta in this instance rises to $\frac{1}{4}$ the length of the internal space, four ovules in two series being found in each of the four basal divisions, two erect and two pendent. The fruit is from 1–$1\frac{1}{4}$ inch long, and $\frac{5}{8}$–$\frac{3}{4}$ inch broad across the wings, which are equal.

2. *Halesia diptera*, Linn. Sp. 636; Cav. Diss. vi. 338. tab. 187; Mich. Fl. Bor. Amer. ii. 40; Pursh, N. Am. Fl. ii. 450; Lod. Bot. Cab. t. 1172; A. DC. Prodr. viii. 270;—ramulis subangulatis, cortice in fibrillis longis rimoso; foliis oblongo-ovatis, acumine angustato, imo acutis, margine denticulatis, dentibus glandulosis, supra læte viridibus, subglabris, subtus pallidioribus, obsolete puberulis, margine ciliatis (junioribus pubescentibus), petiolo canaliculato vix puberulo; floribus 3–4 majoribus, et ut in præcedente in axillis annotinis aphyllis præcocibus, pedicellis flore brevioribus, nutantibus, et cum calyce tomentosis; calycis dentibus acutis, petalis 4–5, sparse molliter puberulis, staminibus 8, filamentis latis, membranaceis, glabris, imo vix agglutinatis; ovario semisupero, tomentoso, stylo hinc usque ad medium puberulo, superne glabro, et sæpissime in filis 3 tenuibus fisso; fructu semper alis 2 latis, 2–3 obsoletis aut angustissimis.—In Carolina, Georgia, et Florida.—*v. v. in hort. Kew.*

The tree from which the above diagnosis has been drawn has always been considered by every one attached to Kew Gardens as the *Styrax grandifolium* of Aiton. Mr. Smith, who has been in that establishment for a period of thirty years, says that when he first went there this tree was understood to be Aiton's plant above mentioned; but although differing essentially in character, no one during this interval has suspected it to be otherwise than the species mentioned. Last year I watched its growth, with the hope of finding for examination the fruit of an American species of *Styrax*; but, to my surprise, I found it to belong to *Halesia*, when I was assured that it had never been known to produce fruit before. On comparing it with authentic native specimens of *Halesia diptera*, I am unable to distinguish any specific difference between them; but as many essential discrepancies exist in the published accounts of the plant, I have given the above diagnosis from my own observations. I find one peculiarity in the leaves which does not appear to have been noticed: they are serrato-denticulated, and each tooth is terminated by a distinct stipitate gland, as I have noticed in some species of *Cyrta*. The tree scarcely exceeds 8 or 10 feet in height—little more than half the size of *H. tetraptera,* and is more frondose. Its leaves are from $3\frac{1}{2}$–4 inches long and $2\frac{1}{2}$–$2\frac{3}{4}$ inches broad, upon a petiole of 6 or 7 lines in length. Its peduncles are not articulated with the calyx; they are 6 lines long; the calyx is 1 line; the petals are 10 or 12 lines long and 3–4 lines broad, tapering towards the base. The stamens are 8 or 9 lines long; the filaments broad and membranaceous, quite glabrous; the anthers 2 lines in length: in the bud the filaments adhere by their margins for their whole length; but when the flower is expanded they are free nearly to the base, afterwards quite unconnected, and also unattached to the petals. The upper free moiety of the ovary is conical, tomentose, and continuous with the style, which is slender, pubescent, and 9 or 10 lines in length. It frequently occurs that the style becomes deeply trifid, being divided for a third of its length into three fine threads,—a circumstance that does not occur in *H. tetraptera,* nor is it anywhere recorded of this species. The placenta rises to near the middle of the cell of the ovary; and it bears a greater number of ovules than the former species. The fruit has only two opposite wings, the others being almost obsolete; it measures $1\frac{1}{4}$ inch in length and $\frac{3}{4}$ inch in breadth: the nut is fusiform, as in the other species. The parts of the flower, though generally 4-merous, are very frequently 5-merous, so that this character alone ceases to form a distinction between *Halesia* and *Pterostyrax*[*].

3. *Halesia parviflora,* Mich. Fl. Bor. Amer. ii. 40; Lindl. Bot. Reg. tab. 952; A. DC. Prodr. viii. 270.—In Florida et Georgia.

7. Pterostyrax.

We have no knowledge of this genus beyond the description of Zuccarini in Sieber's 'Flora Japonica,' where the typical species is figured. Having seen a specimen in flower in Sir William Hooker's herbarium, I am enabled to speak of it with more confidence. The character, as given by Zuccarini, agrees well with the structure of the flower in *Halesia,* differing in no respect except in the pentamerous disposition of its parts; but even that distinction I have shown to be of no value, because we sometimes meet with five petals in *Halesia,* while in *Ptero-*

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[*] Analytical figures, showing the floral and carpological structure in these two species, will be given in Plate 31.

styrax corymbosa I have found some of the flowers with only four teeth in the calyx, with four petals and eight stamens, all resembling in size, shape, and structure those of *Halesia,* the ovary being at the same time of similar form, and in like manner 4-locellate at its base; indeed I can perceive no difference whatever in the structure of the tetramerous flowers of *Pterostyrax* and those of *Halesia.* There is, however, a considerable disparity in their respective habits; and this appears to constitute the principal generic distinction. Zuccarini describes the calyx as having five nervures between the lobes; but he omits all mention of the carinate nervures, which, proceeding from the points of the teeth, run down decurrently along the pedicel, exactly as in *Halesia*; in the latter genus we find the same intermediate nervures as are ascribed to *Pterostyrax.* The petals are spathulately oblong, membranaceous, and free to the base, as in *Halesia diptera*; and I find their æstivation to be quincuncially imbricate, not sinistrorsely convolute, as stated. The stamens are quite similar in form to those of the species last mentioned, the filaments being broad, flat, membranaceous, and pubescent, slightly cohering together at the base, and even there being separable by the slightest force: the anthers are a very little broader than the filaments, the parallel cells separated by an interval, and dorsally adnate to the filaments, not affixed to them by their base, as they are described to be. As in *Halesia,* the ovary is half-superior, and in like manner has a central placenta rising to the middle, leaving the upper moiety 1-locular, its lower portion being divided into four or five divisions, which, branching from the placenta, are continuous with as many parietal nervures that run 403 up into the hollow style. The fruit of *Pterostyrax* is much smaller, scarcely more than one-fourth the size of that of *Halesia,* and its nut is much thinner in substance; but its structure is quite analogous, leaving little doubt that it has undergone the same peculiar mode of growth and development as that before described in the latter genus. In the only seed-vessel I have seen, the seeds were destroyed by age. The habit of *Pterostyrax corymbosum* is more like that of *Styrax Obassia,* its leaves having the same kind of deep sharp serratures: its inflorescence, as in *Styrax,* is racemose, the racemes being many-flowered, and axillary as well as terminal in the young branchlets. Its flowers are smaller than those of *Halesia tetraptera,* and about one-third the size of those of *H. diptera.*

The following generic character has been framed from my own observations:—

PTEROSTYRAX, Sieb. et Zucc.—*Flores* hermaphroditi. *Calyx* parvus, turbinatus, ovario adnatus, margine libero, hic 4-5-

dentatus, dentibus acutis, medio nervis decurrenti-carinatis. *Petala* 4–5, dentibus calycinis alterna, spathulato-oblonga, tenuiter membranacea, sublibera, æstivatione imbricata. *Stamina* numero petalorum dupla, uniseriata, subæqualia, petalis paullo breviora; *filamenta* late loriformia, membranacea, sublibera, vel basi laxe agglutinata, 1-nervia, intus stellato-pilosula, extus glabra; *antheræ* introrsæ, summo filamentorum omnino adnatæ, et iis 5-plo breviores, 2-lobæ, lobis discretis, parallelis, rima longitudinali dehiscentibus. *Pollen* trigonum, angulis bulla rotunda notatum. *Ovarium* turbinatum, semisuperum, dimidium inferius calyci adnatum, hinc post anthesin cito deorsum elongatum, et valde auctum; dimidium superius non augescens, hinc conicum, liberum, immutatum, fructum coronans; 1-loculare, imo septulis 4–5 brevibus ad placentam centralem e basi ortam nexis, et cum carinis totidem internis prominulis parietalibus intra stylum percurrentibus continuis, hoc modo breviter 4–5-locellatum, locellis superne apertis, et lobis calycinis oppositis; *ovula* ad placentam centralem in quoque locello 2-seriatim affixa, inferiora pendula, superiora erecta, fere omnia abortientia. *Stylus* simplex, staminibus longior. *Stigma* clavatum, summo 4–5-denticulatum. *Fructus* oblongus, siccus, indehiscens, 4–5-alatus, alis interdum fere obsoletis, apice summo persistente ovarii coronatus; structura *Halesiæ* omnino similis, sed minor, et substantia nucis tenuior.

Frutices *Japonicæ habitu* Styracis, *pilis stellatis tomentellis;* folia *alterna, acuminato-ovata, argute glanduloso-serrulata;* inflorescentia *racemosa;* racemuli *in ramis novellis axillares et terminales.*

1. *Pterostyrax corymbosum,* Sieb. et Zucc. Fl. Japon. i. p. 94. tab. 47; A. DC. Prodr. viii. p. 269.—In Japoniæ merid. montosis.

2. *Pterostyrax micranthum,* Sieb. et Zucc.; Walpers, Ann. i. 500. —In Japonia.

3. *Pterostyrax hispidum,* Sieb. et Zucc.; Walpers, Ann. i. 500.— In Japonia.

On the Development of the Vegetable Ovule called 'Anatropous.'

Although the changes that take place in the development of the vegetable ovule have long since occupied the attention of the ablest physiological botanists, it is evident that the real nature of its mode of growth is not yet well understood. My first object therefore

is to show that the doctrine upon this important subject, as taught in the best elementary works, is founded upon a very grave error. I was led into this inquiry by my desire to ascertain the nature of the fleshy covering enveloping the hard tunic in certain seeds *, and which appeared to me arilloid in its nature. This was contested by Dr. Asa Gray, who considered these two very opposite kinds of tunics as one baccate testa, both deriving a common origin from the primine of the ovule†. To this view I was unwilling to subscribe; and in my subsequent discussion of the subject, trusting fully to the orthodoxy of the common creed of botanists on the development of the ovule, I argued ‡ that the fleshy covering in question must be an expansion or growth of the placentary sheath, because it enclosed the raphe: and so it is undoubtedly—but not in the light of an extraneous expansion, as I then viewed the question. This induced me to examine, by personal observation, the actual progress of growth of the ovule in certain plants which produce what have been called anatropal seeds; and I soon became convinced that I had been led into an error of inference, solely by my faith in the universally prevalent creed. Having lately completed the investigation of many *Rhamnaceous* and *Anacardiaceous* seeds, in which several novel points of structure have been observed, which are difficult to explain, I am desirous, before the publication of these results, that the real nature of the development of the ovule should be well understood. I therefore now proceed to show that the doctrine upon this subject, as at present taught, is completely fallacious.

It is important to observe, that the late Mr. R. Brown, to whom science is so greatly indebted for his grand discoveries on this subject, and who in simple language first explained the nature of the changes that take place in the development of the ovule §, does not describe the mode of action objectionably assumed in the writings of physiological botanists; and it is worthy of remark that he never adopted the nomenclature founded upon the doctrine here alluded to ||.

To Brongniart, who pursued these great discoveries, the highest merit is due for his able and patient investigation ¶ into the

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* Trans. Linn. Soc. xxii. 81.

† Journ. Linn. Soc. ii. 106.

‡ Ann. Nat. Hist. 3rd ser. i. 276.

§ Appendix to King's Voyage, p. 43.

|| The way in which Mr. Brown uses the term *inverted* is in a comparative sense: *loc. cit.* p. 52, where he says, "the inner membrane is inverted with respect to the external umbilicus," or, in other words, that the chalaza is opposed to the hilum; but he does not allude to any *action of inversion* of the ovular tunics.

¶ "Mémoire sur la Génération et le Développement de l'Embryon dans nature of the pollen, the peculiar structure of the stigmatic tissues, the mode in which the pollinic influence is conveyed into the ovary, the structure of the ovule, of its proper tunics, and of the nucleus, the development of the embryo-sac, the production of the embryo, and the means by which the seed is finally perfected. It is also deserving of notice, that in all these careful investigations, no allusion is anywhere made to the inversion of the nucleus, or to any excentric growth of the original tunics that might effect the kind of inversion since assumed to take place in an anatropal ovule. It is true that both he and Mr. Brown commenced their researches upon the ovule from the moment it is ready to receive the pollinic influence; but had either of these careful observers witnessed any such previous action of growth, they would not have failed to allude to the subject.

Mirbel, who confirmed and extended these interesting researches in his celebrated memoir on the development of the ovule *, has received the highest eulogiums from all quarters, for the benefit which these discoveries rendered to science; but it appears to me that the greatest share of this merit is due to Brown and Brongniart, who preceded him in these inquiries. Much praise is certainly due to Mirbel for the lucid manner in which he repeated and confirmed the facts already brought to light by those who preceded him, and also for tracing the growth of the nucleus and ovular coats from their first appearance, which his predecessors had not noticed; but his greatest claim to distinction rests upon the nomenclature which he devised in order to express the changes observed, which will make his name prominent in the annals of embryology. It is, however, deeply to be regretted that the more original matter contributed in that memoir, or rather, his explanations of the facts there related, should have laid the foundation of the great error in the history of these developments, the fallacy of which I now proceed to demonstrate.

In order that I may be free from the blame of misrepresenting this subject, I will here quote from the following authorities the doctrines they have severally published.

Mirbel says (*loc. cit.* p. 612) that the *anatropal* ovules "*se renversent tout entiers,* et durant *ce mouvement de conversion* le

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les Végétaux Phanérogames." Ann. Sc. Nat. xii. pp. 14, 145, 225, tab. 34—44: read before the Academy, Dec. 28, 1826.

* "Nouvelles Recherches sur la Structure et les Développemens de l'Ovule végétale." Mém. de l'Acad. ix. p. 609: lu à l'Académie 28 Dec. 1828. Additions dans un 2nd mémoire lu 28 Dec. 1829; *idem,* p. 629. planches 1–10.

raphé se développe avec la primine, et *transporte le hile de la base de l'ovule à son extrémité supérieure*; ce sont les Anatropes; mais le développement du raphé fait que le *hile* s'éloigne de la chalaze, et *va prendre place* à côté de l'éxostome" (micropyle). He says again (p. 631), "Le funicule, dans un grand nombre des espèces, *se soude longitudinalement* à la primine depuis l'endroit où il forme la chalaze, jusqu'à une distance plus ou moins éloignée d'elle. *Alors* il se montre à la superficie de la primine comme une ligne en relief, qui se termine à la base de l'ovule; cette ligne est le raphé; mais quand il n'y a peu d'adhérence entre la primine et le funicule que là même où les vaisseaux funiculaires pénétrent dans la secondine, la chalaze se confonde avec le hile, qui est le point d'attache du funicule sur la primine, et la place manque pour un raphé." Again (p. 649), "Quand un ovule tend à l'anatropie, la chalaze, c'est-à-dire l'extrémité du funicule, se porte en avant, non dans la direction de l'axe, mais dans une direction un peu oblique, et en suivant une ligne courbe, qui par sa partie supérieure se rapproche insensiblement de l'axe, et tandis que ce mouvement s'opère, *le sommet par un mouvement inverse se dirige vers la place que la base a abandonnée. Il y a donc échange de position entre les deux extrémités de l'axe de l'ovule; cette axe, poussé obliquement par la chalaze, semble se mouvoir comme une aiguille de boussole que l'on ferait tourner sur son pivot.* Mais la chalaze n'étant que le bout du funicule, l'évolution ne saurait s'opérer sans un allongement de ce cordon, égal au moins à la longueur de l'axe de l'ovule."

If we examine the series of progressive analytical drawings by which these changes are demonstrated in that celebrated memoir, we find that the figures are diametrically in contradiction to the explanations. The former, which portray the facts as he saw them, offer the more reliable testimony of the real truth: for example, in plate 3, showing the progressive growth of the anatropal ovule of *Aristolochia*, fig. 1 is a simple pullulation from the placenta, the rudiment of the primine, or what I have called the placentary sheath, because it encloses in its tissues the nourishing vessels that terminate in a certain budding point, and that form the future raphe; it is not the nucleus, as is generally taught. Close to the extremity of this, out of a circular depression, the first appearance of the nucleus is exhibited in fig. 2. The secundine next presents itself in the same hollow, surrounding the base of the nucleus in fig. 3. After this we observe the gradual swelling of the under part of the nuclear support, or the downward growth of the placentary sheath, which becomes the primine, in the form of a bag suspended by the remaining stipitate portion of the sheath or funicle,—the original margin of the depression first described remaining as the mouth of this bag, and constituting the foramen of the primine (micropyle or exostome), which from first to last never changes its position or its aspect—a most important point to be observed. During this action of centrifugal growth, the chalaza, or place of attachment of the nucleus, necessarily recedes from its original position, remaining at the bottom of the growing bag or primine, the extension of the nourishing vessels keeping pace with its *downward* growth, and still terminating in the now basal chalaza; at the same time, the enclosed nucleus and secundine severally grow *upwards*, both constantly attached to the budding or chalazal point of their origin: all this is seen in fig. 5, which represents a perfect ovule ready to receive the pollinic influence. We find in fig. 6 exactly the same disposition of the parts after the ovule has been impregnated, and when the embryo-sac with the nascent embryo has been developed. In these several stages we perceive that the foramen of the primine, the mouth of the secundine, and the apex of the nucleus, from first to last, all culminate towards one common point, while the basal portions of the same parts as constantly point downwards: if the expression may be allowed, they all retain the same uniform polarity; there is *no inversion* in any of the parts, or even an approach to it; *the hilar or funicular point* of attachment *is not transported from the base of the ovule to its superior extremity*, as asserted; and there is *no agglutination* (*soudure*) *of the primine to the cord of the raphe,* elongated by this assumed act of semirevolution of the ovule. In fine, although the mode of growth, as shown in the drawings, is perfectly correct, there is throughout the whole description a misconception, and a complete mistake in the use of all the terms employed by Mirbel, especially in those I have denoted by italics. The same mode of growth is again still more fully demonstrated in plate 7, in the instance of *Tulipa.* Nowhere among the other numerous exemplifications in this celebrated memoir can we find any material variation in the direction of the parts of an anatropal ovule: this only exists in campylotropal or amphitropal ovules, where, of course, owing to the curvature of the several parts, from an excessive one-sided growth, a more or less partial inversion takes place.

The same erroneous description is given by the able St.-Hilaire in his 'Morphologie Végétale' (p. 540), where he thus defines the development of an anatropal ovule. Its first appearance upon the placenta is a small protuberance (wrongly said to be the *nucleus* of the future ovule), which by degrees becomes covered by two cups that rise successively from its base and form the future tunics, primine and secundine. The so-called "ovules anatropes, par la *courbure* graduelle de la *base de leur axe*, se rapprochent peu à peu du cordon ombilical, et après avoir *décrit* *un demi-cercle, le rencontrent, se soudent* avec lui, et le confondent en quelque sorte dans leur substance; souvent le cordon, *ainsi soudé,* se montre comme une proéminence extérieure, mais souvent aussi il ne se laisse point apercevoir; *la partie soudée* du cordon porte le nom raphé." In order to impress this action more forcibly upon the conviction of his readers, St.-Hilaire compares the ovule so developed, to a monopetalous flower in bud, which is made to perform half a revolution, by being inverted and suddenly bent down close to its base, with its peduncle agglutinated to the calyx and corolla; here the calyx and corolla assume the position of the tunics of the ovule—its ovary, the nucleus—and their common base of union, the chalaza,—the pedicel representing the raphe.

A very similar explanation of the anatropy of the ovule is given in the excellent work of Adr. de Jussieu (Cours Élémenmentaire, p. 343), where his definition is aided by figures. Fig. 1 is again erroneously said to be the *nucleus, first developed;* fig. 2 the same, with the primine next appearing; fig. 3 the same, more advanced, with the addition of the second coat (secundine). "Le développement ne marche pas ainsi égal de tous les côtés; *sur l'un il est très-prononcé,* tandis qu'il reste à peu près *stationnaire sur le côté opposé.* Par là, *la pointe* de l'ovule, avec son micropyle *tourné primitivement en haut, se tourne de côté,* puis un peu plus tard en dehors, *puis enfin tout à fait en bas* (fig. 4) *après avoir fait ainsi un demi-tour de révolution. La chalaze* emportée de même avec les tégumens qui s'étendent, et conservant ses rapports avec le micropyle, *fait une révolution analogue,* mais en sens inverse, *et marche de bas en haut,* de manière qu'elle s'éloigne de plus en plus du hile, dont le micropyle au contraire s'est rapproché de plus en plus." Fig. 5 shows a section of the same ovule, where it is explained how "le faisceau vasculaire qui aboutissait à la chalaze, la suit dans sa révolution en s'allongeant, et ce prolongement forme le raphé." I was led into error of argument, as I have mentioned, solely by my faith in the truth of this last consideration, a doubt of the correctness of which never crossed my mind, taught as it was by such eminent authorities.

The definition of Prof. Lindley (Introd. p. 180) is less explicit, and therefore less objectionable; but he evidently entertained a similar view, though expressed in different terms. He states that in this kind of ovule "*one of its sides grows rapidly, while the opposite side does not grow at all,* so that the *point* (foramen) of the ovule *is gradually pushed round to the base,* while, correspondingly, *the base of the nucleus is removed from the hilum to the opposite extremity*; and when this process is completed, *the whole of the inside of the ovule is reversed.*" It is needless to repeat that this definition is founded upon misconception, or on too much faith in the erroneous descriptions of Mirbel and St.-Hilaire.

Dr. Fritsche (in 1835) was the first who impugned in part the accuracy of Mirbel's observations on the development of the ovule in *Cucurbita.* Mirbel had described the first indication of the growing ovule as a simple cylindrical shoot protruding from the placenta, which after a while exhibits a point, somewhat excentrically placed near its apex, out of which the nucleus forces an opening; this nucleus continues to grow, becoming surrounded at its base by an annular ring, the rudiment of the secundine, while the lacerated opening out of which the nucleus springs forms the mouth of the primine and gives rise to the outer coat of the ovule. Fritsche confirms the accuracy of the appearances thus described, but contends* that the nucleus does not originate in a sort of coleorhizal protrusion as narrated by Mirbel, but that the whole placental shoot in question is in reality the nucleus upon its funicular support, before any indication of the primine and secundine: this shoot is covered by a single epidermal layer of cellular structure; and at some little distance from its extremity a double circular constriction is formed, thus leaving a prominent annular ring round the papilla, which remains as the nucleus, while the portion of the epidermis between the two strictures separates from the internal parenchyma and becomes plicated, so that its folded surfaces unite together in the form of a short tube, thus giving origin to the future secundine. Subsequently that portion of the epidermis below the strictures also separates and becomes folded in like manner, thus giving rise to the future primine. This assumption of the separation of the epidermis I believe to be quite erroneous, for reasons presently to be given; and it will be seen that, in regard to this early stage in the development, Mirbel was nearer the truth than his opponent.

Schleiden, although he seems to have adopted the erroneous views of Fritsche concerning the earliest origin of the nucleus and ovular tunics, gave (in 1843) an account of their subsequent development and growth, somewhat different from that of Mirbel: he says†, "The funiculus is much elongated, the nuclear papilla bends downwards; and thus the side, either of the naked nucleus or of the simple or of the external bud-integument (secundine or primine), turned towards the funiculus, becomes blended with it. In the perfect seed-bud the nuclear papilla then lies close to the point of attachment, the chalaza opposite to it, and the line from the centre of the chalaza through the middle of the nucleus is straight: such a bud is termed reversed (*gemmula anatropa*); the adherent part of the funiculus is termed the raphe." Schleiden farther aptly remarks—"Excepting Fritsche, not a single botanist has done anything on this weighty point of our subject, not even so much as to re-examine the researches of the distinguished Mirbel and Brown; and we find in consequence, even up to the most recent dates, the false views of Mirbel (and these often sadly disfigured) copied without reflection."

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* Wiegmann's Archiv, i. 2 Band, p. 229.

† Principles of Scientific Botany, Engl. edit. p. 390.

Prof. Henfrey (in 1847), in his truly excellent 'Outlines of Structural and Physiological Botany' (p. 199), thus defines the nature of the anatropal ovule:—"The nucleus is sometimes so affected by the development, that the apex or micropyle comes to be placed next the hilum, and the organic base of the ovule (the chalaza) at the opposite extremity; the vascular cord communicating with the chalaza is extended during the growth of the ovule, and the chalaza thus always communicates with the funiculus by these vessels, which run in the thickness of the coats, in the exterior where there are two. This cord is called the raphe, looking like a prolongation of the funicle adherent to the side of the ovule, and disappearing at the point, which is the organic base." This description, as far as it goes, is the clearest and most truthful detail of the development of the ovule yet given, as it does not allude to any presumed action of the inversion of the nucleus and its ovular coats, upon which all other accounts are more or less based. This scientific botanist, however, appears subsequently (in 1858) to have adopted the prevalent error in contending that "the inversion of the (anatropal) ovule takes place by a one-sided development of the tunics*."

Prof. Asa Gray has lately pursued this inquiry (in 1857) in a very philosophical spirit, in his investigation into the growth of the ovule of *Magnolia*† from its earliest periods; he confines himself solely to the appearances seen in the different stages of its growth, which he illustrates by figures, without reference to any theory on the subject: those figures well accord with the explanation I have rendered of Mirbel's illustrations of the development of the ovule in *Aristolochia* and *Tulipa*; but there appears to me some little error in fig. 2, where the earliest pullulation is always somewhat excentric in instances of anatropy—never at the extreme tip, which would generate an atropal ovule.

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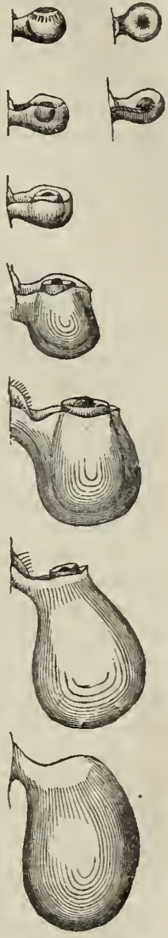
* Ann. Nat. Hist. 3 ser. i. 356.

† "A short exposition of the structure of the ovule and seed of *Magnolia*," Journn. Linn. Soc. ii. 106.



Figs. 1–7.

I need not here recite the details of my own observations made in the spring of last year, upon the mode of growth of the anatropal ovule of *Amygdalus**; suffice it to say that I have repeated them this year with the utmost care, from the very earliest periods of growth, and all that I had previously remarked is fully confirmed. I have noticed here, in every instance examined, as shown in the marginal figures, a deep depression completely upon one side (never at the extremity) of the wart-like pullulation from the placenta, which I have called the placentary sheath, because it encloses in its parenchyma the tracheal vessels of the future raphe, in the bottom of which hollow there is a small budding-point where the vessels terminate; and out of this point the nucleus originates, standing in the bottom of the hollow: this nucleus soon becomes surrounded by the annular rudiment of the secundine, while the margin of the depression by degrees expands into a cup of a horse-shoe form, the two arms of which abut upon and embrace a lamellar plate of the placenta, and the opposite extremity is rounded into a concentric form, surrounding and including the nucleus and secundine. In *Prunus* the wart-like protuberance is more globular than in *Amygdalus*; and upon one side, not far from the placenta to which it is attached, there is a very deep circular depression, in the bottom of which the diminutive nucleus is seen rising from the budding-point: this is gradually encircled by the secundine; and the deeply hollow support becomes first a cup, which finally grows downward to form the primine, while its margin remains as the micropyle. Neither Mirbel's view nor Fritsche's notion is confirmed by my observations; the many cases I have seen convince me that the early growth of the nucleus and secundine proceeds wholly from the budding-point or future chalaza, which is the point of termination of the tracheal vessels imbedded in the substance of the main support or placentary sheath. This mode of growth is most conformable to the ordinary law of development, and is quite analogous to the production of the sepals, petals, stamens, disk, and ovary from the budding-point of the pedicel, which is furnished in like manner, and for the same purpose, with tracheal vessels. It is a far more reasonable inference than the gratuitous assumption of Fritsche, that the ovular tunics are generated by the spontaneous separation of the epidermis, which doubles itself up, so as to produce those tunics by its further expansion.

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* Ann. Nat. Hist. 3 ser. i. 359.

After this early period, the further increment is very evident: the bottom of the channel I have described, with the budding-point, grows *downward,* becoming by degrees an oblong pouch with a broad, open mouth, suspended by the funicular point of its origin, at the same time that the nucleus and secundine enclosed in it grow *upward;* this continues till we have a complete and suspended anatropal ovule, ready for impregnation, at which period the papillary apex of the nucleus is exposed within the open mouths of the tunics; during this successive growth of the ovule of *Amygdalus,* the apex of the nucleus never changes its zenithal aspect, while the chalaza as constantly points to the base of the cell; there is no one-sided growth of the tunics, which grow equally upon all sides; and there is no inversion of the nucleus or of its coats, according to the opinion generally entertained. In this development, all is beautifully contrived to attain by the most simple means the main function —the generation and perfection of the future embryo, for which purpose the apex of the nucleus is retained always in near proximity to the placenta by means of its short funicle; and close to this point we see, as Brongniart long since demonstrated, a lamellar plate, to which the funicle is attached, which plate, formed of a peculiar tissue, is terminated by a fringed border that overhangs the mouths of the ovular tunics: the articulated cells forming this process bear the name of *telæ conductrices,* because they serve to conduct the pollinic influence to the point of the nucleus, by which means the embryo-sac is impregnated. I mention here this point of structure, because the position of this fascicle of cells, in relation to the raphe, is sometimes an indication of importance, as I shall have to show in the case of the *Rhamnaceæ.*

The mode of origin and the changes that take place in the growth of campylotropal and amphitropal ovules, with some modifications, are quite analogous to all that occur in the anatropal; it is, therefore, unnecessary for our present purpose to speak of them; but in regard to atropal ovules, it is requisite to say a few words. Here the budding-point is at the very apex, not on one side of the placentary sheath; the nucleus therefore makes its first appearance in a depression at that point, where also the secundine soon surrounds it, while the extremity of the sheath is extended by degrees to form the primine,—all three growing straightforward in the same centrifugal direction; the chalazal point is consequently identical with the hilar or funicular point of attachment of the ovule, and therefore there exists in no case any simple raphe, and but rarely any tracheal vessels, except those which exist in the funiculus: the growth of the ovular tunics is just the same as in the anatropal ovules. Spiral vessels, however, are occasionally seen, extending radially beyond the region of the chalaza, through the tissues of the primine, as sometimes occurs in like manner in anatropal ovules.

In the foregoing details of an anatropal ovule, I have mentioned the raphe only as appearing in the shape of a simple cord imbedded in the tissues of the primine, traversing it upon its ventral side from the funicle to the chalaza, where it disappears. But other distinct kinds of raphe occur: it frequently happens that, besides the main cord just mentioned, other branches of the nourishing vessels, as they issue from the funicle, spread themselves in distinct nervures over the whole area of the testa: sometimes, as I have shown in the *Styraceæ,* these ramifications are extremely numerous, the delicate spiral threads being loose or in lax bundles, spread throughout the testa, like a fine web; this also occurs in the testa of *Ophiocaryon, Olea,* and many other seeds. In other cases, again, we find these ramifications radiating in distinct nervures from the chalaza and anastomosing over the surface of the seed; this is instanced in the Almond, to which Prof. Lindley has alluded as presenting an anomaly not readily accounted for; its nature is, however, easily explained. The Almond is generally described as being exalbuminous; for if we cut through the seed, we come immediately upon the large fleshy embryo, which is found enveloped by an apparently single flexible coating, but which on examination is seen to be composed of different integuments agglutinated together. The inner coating is easily detached by a blunt point introduced beneath it, by which means it may be separated entire; it is then very thin, almost membranaceous, opake, white, not reticulated, but apparently formed of minute aggregated cells, and perfectly homogeneous in all its parts; it is somewhat thickened over the radicle, and comes away from the chalaza without discoloration, as easily as from all other parts of the surface; in fact, notwithstanding its attenuation, it presents all the characters of albumen. Intermediate between this and the external integument is a delicate membrane, which is separable with some difficulty, this being the tegmen, finely reticulated: the external testa is much thicker, opake, with a rugose surface. Upon raising the tegmen, we find, lying beneath it, several bundles of spiral threads in anastomosing bands, so loose that each fibre can be easily drawn out separately; these bundles of vessels constitute the branching raphe just described, the ramifications of which appear to issue from the chalaza, where the integuments are united in a solid disk. The source whence these vessels derive their origin in the chalaza may, however, be traced to the main cord of the raphe, which forms a thick bundle running from the hilum to the basal disk. The two integuments are so closely agglutinated together, that it is not easy to determine through which of them the branching portions penetrate; the main cord is manifestly in the outer tunic.

On two former occasions, I recorded two very unusual cases in which the raphe becomes entirely peripherical, that is to say, first runs in the usual manner up one side from the hilum to the chalaza, and then returns again along the opposite side of the seed to the hilum—in both directions in the form of a simple continuous cord: the one instance was in *Stemonurus**, a genus of the *Icacinaceæ*; the other appeared in *Cucurbitaceæ*†. I have yet to show that a similar abnormal course of the raphe is universal, as far as I have been able to ascertain, in *Rhamnaceæ*. The consideration of this peculiar development will be deferred till I have detailed all the curious circumstances connected with it, in a memoir just completed.

In the *Euphorbiaceæ*, the raphe, as a thick simple cord, runs in a straight line from the hilum to the opposite chalazal extremity, where it is imbedded in the outer tunic, which is sometimes as thick and fleshy as in *Magnolia*, and where, as in that genus, a distinct bony shell intervenes between that coating and the thin inner integument: this raphe perforates the shell through a small diapylar foramen, to reach a small chalaza at the base of that integument; and out of this chalaza I have sometimes observed other vessels distributed over the area of the tegmen, in ten or fewer radiating and almost parallel bands which extend from the base to the apex. The existence of an external arilline, in which the main cord of the raphe is imbedded, and which is often of a scarlet colour, is common to all the *Euphorbiaceæ*; and this is always more or less fleshy, and invariably invests the bony shell usually denominated the testa, but which shell, in all cases, I have found devoid of tracheal vessels.

The development of the ovule in its early stages is subject to many modifications, which, in different families of plants, are often constant; and these afford good characters, hitherto little noticed. Some interesting facts on this head were recorded by

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* Ann. Nat. Hist. 2 ser. x. 33; Contributions to Botany, i. p. 83, pl. 13; Trans. Linn. Soc. xxii. p. 98, pl. 19. figs. 6, 7, 8, 9.

† Trans. Linn. Soc. xxii. p. 92, pl. 19. figs. 47, 48, 49.

Mr. B. Clarke, eight years ago*, when he pointed out the importance of knowing the position of the raphe in its earliest development,—a character he employed to show the relation of different families in a systematic point of view, according to his own peculiar notions.

Prof. Agardh has very lately contributed a valuable collection of facts upon the same head, and with the same view, to which he has attached more importance than they deserve; still, the facts demonstrated by him claim our especial notice, as they are accompanied by nearly 500 figures illustrative of the modes of development of the ovule in 310 different genera of plants. He has shown how much the position of the raphe, in regard to the axis of the ovary, varies in different families, and even in different genera, of the same order; and in his novel systematic arrangement of Phanerogamia†, this difference has in many cases led him to break up many natural orders into distinct groups, which he separates by long intervals, while at the same time he places in juxtaposition other families of little real kindredship, thus suggesting a distribution quite incompatible with our generally received notions of real affinity. But although this new system is not likely to receive the support of botanists in general, still the many observations, and the numerous facts and drawings here contributed, will show the value of the character of the development of the ovule, if applied only as an accessory feature. In order, however, to elicit the true value of this character, it should be followed through all the changes of subsequent growth, up to the period of the perfection of the seed,—a consideration not attended to in that work. I have shown the importance of this last consideration in the *Styraceæ*, especially in the tribe *Halesieæ*; and I have yet to detail developments of a similar nature in other families which I have investigated. It is with the view of extending this inquiry that I have brought together these remarks.

It is evident from the foregoing exposition that the word *anatropal*, as applied to an ovule developed under a certain condition, is a very incorrect term, and one that might with propriety be abolished, because it serves to perpetuate a prevailing error; but it may still be retained if we limit its signification to a comparative instead of an active sense,—meaning, by the word *inverted*, a different position of the radicle in regard to the hilum in anatropal seeds—not as expressing any action of gradual inversion of the nucleus and its tunics, as has been assumed.

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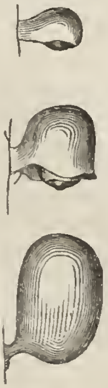
* "On the Position of the Carpels when 2, and when single; including Outlines of a new Method of Arrangement of the Orders of Exogens, and Observations on the Structure of Ovaries consisting of a single carpel." Proceed. Linn. Soc. ii. 105.—"On the Position of the Raphe in Anatropal Ovules," *ibid.* p. 147.

† Theoria Systematica Plantarum: Lundæ, 1858.

I will now proceed to show that the development of the raphe is always normally ventral, or next the placenta, and that when it assumes a dorsal position, this is due exclusively to a resupination of the entire ovule. I have already explained the difference in the incipient development of an anatropal and an atropal ovule—that in the former the pullulation of the nucleus is never from the extreme point, but always more or less removed from it, and in general completely on one side of the placentary sheath; this is either on the upper or the lower face, but sometimes lateral, and in these cases the growth of the ovule is either downwards or upwards, or laterally in regard to the axis of the ovary, producing thus either pendent, ascending, or laterally horizontal ovules. When the first appearance of the nucleus is on the superior side of the funicular sheath, we have a pendulous ovule, with the raphe necessarily on the ventral side of the primine (as shown in the marginal figures in p. 204), in all cases where the point of its attachment upon the axis of the carpel is at any sufficient distance above the base of the cell to allow of its downward growth; but if this point of origin be contiguous to the base, then the downward extension of the primine, pressing against the bottom of the cell, causes the ovule to incline upwards gradually into an erect position (turning thus upon its funicle, as Mr. Brown first sagaciously demonstrated in the case of *Euonymus*), so that the ovule becomes completely reversed, with the raphe upon its dorsal face. In the same way, when the pullulation of the nucleus is upon the lower side of the funicular sheath, we have necessarily an ascending ovule with a ventral raphe, produced by the upward expansion of the sheath, as in the marginal figures, showing the first and two later stages of this growth, which prevails in all cases where the ovule has sufficient room to expand itself; but where this production of the funicular support is close to the summit of the cell, then the pressure of growth causes the ovule to be forced round gradually upon its funicle till it becomes pendent, with its raphe in a dorsal position. In both these instances of resupination of the ovule, there is no removal of the mouths of the tunics from their close contiguity to the *telæ conductrices*,—a very important feature in the history of its development. These two conditions of growth of the placentary sheath may be expressed by the terms *epipyla* and *hypopyla*,—the former from ἐπὶ *super*,

Figs. 8–10.



πύλη *porta,* where the first development is upwards; and the latter from ὑπὸ et πύλη, where it shows itself on the lower side of the sheath. In the first condition (where the micropyle points upwards), we have an *ovulum anatropum epipylum,* or a pendent ovule with a ventral raphe; but where the same ovule becomes inverted by pressure, we have an *ovulum epipylum resupinatum,* or an ascending ovule with a dorsal raphe. Under the second condition (where the micropyle points downwards), we have an *ovulum anatropum hypopylum,* or an ascending ovule with a ventral raphe; but when this becomes inverted by pressure, it is an *ovulum hypopylum resupinatum,* or a pendent ovule with a dorsal raphe. It often happens, where numerous ovules issue from a placenta of limited extent, that we have erect, horizontal, and pendent ovules all crowded together, some with a ventral, others with a dorsal raphe; but it will be found that all are equally epipylous or equally hypopylous, the one series showing their raphes in their normal position, the second intermediately placed, while the third, by their resupination, have a dorsal raphe. Under the third condition, where the ovules are in collateral pairs, and where the earliest appearance of the nucleus is upon the lateral face of the placentary sheath, the raphes face one another, whether the subsequent direction of the ovule, by the pressure of growth, be pendent, horizontal, or ascending: this kind of development may be called *allopylar* if in a single ovule, and *heteropylar* when in collateral pairs.

Another consideration worthy of attention in the development of the ovule, is the position of the embryo in regard to the seminal tunics,—that is to say, whether one of the faces of the cotyledons, or whether its margins be placed opposite the raphe: this point has seldom been regarded, except where the embryo is amphitropal or campylotropal, in which cases this position is known, from the radicle being said to be incumbent or accumbent in regard to the cotyledons. This relative position is often a constant feature in certain families, while in others it is subject to much variation, as in *Rhamnaceæ;* and the character is even sometimes variable in the same genus, as in *Rhamnus.* The position of the face of the cotyledon in regard to the axis of the ovary is a feature very distinct from that of its relation to the raphe; and the two should not be confounded together: thus in *Rhamnus catharticus* the raphe is dorsal, both with respect to the axis of the ovary and to the embryo; in *R. chlorophorus* it is dorsal with regard to the embryo, but lateral as respects the axis of the ovary. In most instances throughout the *Rhamnaceæ* the embryo is incumbent with respect to the ovary, one of its cotyledons being posterior, the other anterior, in regard to the axis; but it is accumbent in regard to the raphe, which skirts the margins of the cotyledons. In *Berchemia* the cotyledons are incumbent, both with regard to the ovary and to the dorsal raphe.

In this investigation, I have noticed only the proper integuments of the ovule, leaving out of consideration that coating which, after impregnation, frequently grows over the primine and produces in the seed either an incomplete or an entire tunic, called an *arillus*. Schleiden and others are of opinion that the true aril must necessarily be pervious at its extremity, and he concludes (*l. c.* p. 431) that wherever an actually closed structure surrounds the seed, it is undoubtedly a layer of the seed-coats: but this is mere opinion unsupported by proof; for it is equally probable that the aril may become closed just as much as the proper tunics of the ovule. It has also been thought that it must necessarily be fleshy; but I have shown* that it is often perfectly entire, and frequently hard and testaceous (as in *Canellaceæ*, *Winteraceæ*, &c.), in which case the true testa, or development of the primine, is generally either fleshy or membranaceous, contrary to its usually hardened condition.

Where, on the other hand (as in *Magnolia*, *Clusia*, &c.), the inner tunic of the ovule becomes hardened by osseous deposits, the primine, as in the former case, remains fleshy, and assumes the appearance of a complete arillus, for which reason I proposed to call it an *arilline*† instead of testa, to which name the hardened tunic is more entitled. It has been contended by Dr. Asa Gray that the osseous tunic and the aril-like covering which contains the cord of the raphe are both developed from the primine, the former resulting from hardened deposits upon its inner layers of cells, while the outer cells remain soft and fleshy. I have argued that, if such a deposition took place in the manner stated, these two dissimilar textures must be enclosed by a single epiderm and one endoderm; but we find, on the contrary, each of the tunics provided with its respective external and internal epidermis, showing that the two formations are independent in their origin. It is also clear, that if these two coatings, so very dissimilar in their nature, were produced from a single ovular tunic, then the cord of the raphe ought rather to be found in the nut, as that would correspond with the inner layers of mesodermic tissue in which the raphe exists in the primine; whereas that cord of vessels is really imbedded in the fleshy tunic, while the nut is free from vessels of any kind. This is further shown in the general structure of the seed of *Magnolia*, where the raphe passes in its usual course through the tissues of the fleshy coating, from the base to the apex, when it suddenly breaks through the endoderm, and arrives at a distinct foramen in the chalazal extremity of the nut, which I have called a diapyle, through which it passes, and soon becomes lost in the thickened areole or chalaza of the inner integument.

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* Ann. Nat. Hist. 3 ser. ii. 39; Contributions to Botany, i. 128.

† Trans. Linn. Soc. xxii. p. 89.

On the other hand, we may conclude either that the nut originates in a development of the secundine, and that the tegmen results from the tercine or membrane of the nucleus (which is a very rational inference), or that the nut is of independent origin (which is still within the range of probability). Indeed there is nothing to prevent the possibility or probability of the formation of an intraneous coat between the usual tunics in the growing seed, subsequently to the closing of the micropyle of the ovule. We frequently meet with a copious deposit of loose cellular tissue between the testa and tegmen, or even between the latter and the albumen; and this deposition may become consolidated into a distinct membrane, or hardened by solid deposits: wherever there exists a budding-point, this may at any time take place. We have proof of the actual formation of such a tunic between the primine and secundine in the *Gnetaceæ**; and this, if applied to the case of *Magnolia*, points to a far more probable cause for the appearance of the hard tunic in the seed, than the improbable suggestion of Schleiden and Gray, to which I have just referred.

Schleiden, although entertaining so many ideal fancies respecting developments, gives nevertheless a somewhat true account of the present state of our knowledge on this subject: he says (*l. c.* p. 427)—"A greater confusion than that which prevails in the theory of the seed-coats is scarcely conceivable; the most heterogeneous things are thrown together under one name; thoroughly identical ones are placed in different kinds of organs; and there is nothing for it, if we would not make greater confusion, but to cut the thread and begin over again: the epidermis of the seed is sometimes described as testa, sometimes as arillus; seed-membranes are introduced where no true integuments exist."

My object in bringing together the facts related in the foregoing pages is to show that we may always proceed with some degree of certainty, if we never lose sight of positive, invariable landmarks. Beyond doubt the surest course is to trace the developments from the earliest growth of the ovule to the final perfection of the seed; but where this cannot be done, notwithstanding the variable texture and condition of the tunics developed from the growth of the primine and secundine, we may always, with much confidence, by attending to the unerring indications afforded by the raphe, generally deduce the true nature and origin of the different coatings of seeds in Phanerogamous plants.

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* According to the interesting details given by Griffith, Lindley's 'Vegetable Kingdom,' p. 233, where analytical figures demonstrate the fact.

On Diclidanthera.

This genus, established by Prof. Von Martius in 1826, was referred by him to *Styraceæ*, on account of its gamopetalous corolla (its stamens being adnate to it, and double the number of its lobes), its simple style, its 5-celled ovary with pendent ovules, its drupaceous fruit, often by abortion monospermous, and its albuminous seed, enclosing an embryo with a superior radicle.

Prof. Lindley (in 1836), following this indication, in his 'Introduction to Botany,' placed the genus in *Styraceæ*, after *Halesia*.

Owing to the peculiar structure of its anthers, Endlicher (in 1839), in his 'Genera Plantarum,' retained it in the same linear position, but separated it as a distinct section, following *Styraceæ*.

No further notice was taken of it until Prof. A. DeCandolle (in 1844), in his monograph of the last-mentioned order (Prodr. viii. 245), merely alluded to it when he excluded it from that family, on the ground of its free ovary, its anthers fixed in the mouth of the tube of the corolla, its pollen striated transversely, and its minute embryo; but he did not assign it any other position.

Prof. Lindley (in 1846), in his 'Vegetable Kingdom,' arranged it, in the Appendix, among those genera whose precise locality in the system is not ascertained.

In 1852 I offered a few observations*, indicating its probable affinity with *Hamamelidaceæ*; but a more critical examination of the genus has since convinced me that it has a nearer affinity elsewhere.

Prof. Von Martius (in 1856), in his 'Flora Brasiliensis' (fasc. 17. p. 11. pl. 4), extended the recital of its generic features, describing at full length, and figuring with much detail of analysis, the two species he had delineated in his 'Nova Genera et Species' thirty years previously. My own observations, aided by the drawings and analyses made in 1837 upon the living plant, differ in several points of structure from those details, as I will presently show; and upon these facts I will proceed to discuss the question of the true affinity of the genus.

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* Ann. Nat. Hist. ser. 2. ix. 130; Contrib. to Bot. p. 46.

Prof. Von Martius, in his later work, after enumerating the several characters showing its affinity towards *Styraceæ*, expresses his opinion that this relationship rests more on outward appearances than on reality; and he proceeds to state his reasons for suggesting its nearer affinity to *Moutabea* (which genus he illustrates at the same time), and, through it, to *Polygalaceæ*. This affinity does not appear to me evident, for the following reasons:—in *Moutabea*, both calyx and corolla are really tubular, and are confluent together for half their length; the borders of the calyx and corolla are both alike in size, and each divided into five segments of unequal proportions; the stamens are combined into a free tube terminating in a ventricose fleshy hood, cleft on one side, as in *Polygalaceæ*,—points of structure at variance with those of *Diclidanthera*. Again, in *Moutabea* the ovules are attached by their middle to the centre of the axile column; the seed has no albumen, and its embryo has large oblong fleshy cotyledons, with a minute radicle drawn in between them on the side of the shorter axis,—features, again, incompatible with all that is found in *Diclidanthera*.

In this genus, as stated on a former occasion*, although the corolla assumes a tubular form, it is not really gamopetalous; the tube is composed of five narrow linear petals, loosely held in juxtaposition by the simple application and agglutination of the thin membranaceous stamens upon their inner surface. Of this fact we may easily be convinced by moistening a flower, then laying hold, one by one, of each segment of the border and pulling it downwards, when each petal comes away separately, without the laceration of either of its margins. Indeed, Martius, in describing the corolla as being monopetalous, qualifies this by admitting it to be "quasi a petalis 5 secundum marginem leviter coalitis:" but in stating that the free lobes of its border have a quincuncially imbricated æstivation, he has overlooked the fact that the margins of their lower portions, in forming the tube, overlap each other contorsively,—that is to say, if we look from the centre of the flower, the dexter margin of each petal is introrse, while the sinister side is extrorse, and quite free in its entire length, appearing like a keel twisted sideways, and ciliated to the base: they are simply held together, as above mentioned, by the adhesion of the extremely thin monadelphous tube of the stamens; and from the point at which that tube terminates, the remaining upper portions are quite free, constituting what have been termed the segments of the border. The same fact is again shown by laying hold of each anther separately and pulling it downwards, when a cor-

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* Ann. Nat. Hist. ser. 2. ix. 130; Contrib. to Bot. p. 46.

responding strip of the staminal tube is torn away to the base, and the petals are thus left quite free: this tube is too delicate and membranaceous to be detached in an entire state without laceration; but the structure, by the treatment I have mentioned, is thus rendered manifest. All the parts of the flower are isometrical in number, and symmetrically arranged: five free linear sepals rise from the hemispherical cup of the calyx; five alternate petals spring from the margin of the cupular disk, which is adnate to this cup; and ten anthers in one regular series are disposed on the summit of the adnate tube formed of the confluent filaments, five being alternate and five opposite to the petals, so that they thus appear sessile in the mouth of the seemingly gamopetalous tube of the corolla. The structure of these anthers offers a striking peculiarity: they are reniform, compressed, erect, affixed by their basal sinus upon a very short and broad portion of the filaments, which are conjoined below into a monadelphous adnate tube, as before mentioned: these anthers consist of two collateral cells, united into a compact body; and they open a little obliquely by a lateral fissure, or rather by a hippocrepial line round their margin, into two unequal valves, the posterior retaining its naturally erect position, the anterior valve becoming bent downwards. If we compare this structure with the stamens of *Büttneria,* we perceive a close similarity between them,—the chief difference being that in the latter case the monadelphous tube of the stamens is free from the corolla down to its base, the union of the filaments is there not complete, and the free portions of the filaments appear as so many segments of the border of the tube. Gay, in his monograph of the family of the *Büttneriaceæ,* shows that in *Commersonia Fraseri** five of these stamens are anantherous, much extended, and 3-fid, and five alternately short and antheriferous; its anthers are reniform, like those of *Diclidanthera,* and are fixed by their sinus to the apex of the short broad filament, which is reflexed at its apex, and the stamens appear as if they were extrorse; each anther, in like manner, opens by a hippocrepial line bilabiately, the internal valve remaining pendent, and the more external valve rising into a vertical position, so that the anther thus expanded is peltate, its cells being collaterally placed. If we imagine the monadelphous tube in this case, as well as its free segments, to be agglutinated to the corolla, as in *Diclidanthera,* the anthers would necessarily be erect, instead of reflexed, we should find them placed exactly as in that genus, and their dehiscence would be precisely similar.

The ovary is globular, decidedly stipitate, as in *Büttneria,* and in like manner five-celled, with two ovules, one of them often rudimentary, suspended from the central column below the apex of each cell by a very short funicle; the primine has a wide tubular mouth in its summit, close to the funicle; and the raphe is distinguishable, extending along the ventral side to the base. Although, in the *Büttneriæ*, the ovules are generally numerous in each cell, they are reduced to two, placed collaterally, in *Rulingia*. In the ripe fruit of *Diclidanthera*, each suspended seed is oval and compressed: the external tunic, which becomes black in drying, is covered with a white retrorse pubescence: the intermediate tunic is somewhat coriaceous and of a red colour, polished, and free from the outer tunic in the fresh state, but becomes intimately agglutinated to it in drying; it is marked by a distinct hilar scar at its summit when fresh, and by a chalazal areole at its base: the inner integument is white and membranaceous. The embryo is of the breadth, and $\frac{5}{6}$ths of the length of the fleshy albumen by which it is enveloped; the cotyledons are large, nearly orbicular, slightly cordate at their base, thin, foliaceous, veined, and of a greenish colour in the living state; the radicle is short and terete, and nearly touches the summit. This embryo is described and figured by Von Martius as being very minute, in the summit of the albumen: this is certainly an error, originating probably in the seeds examined by him being in an immature state. It should be observed that this structure resembles that of the seeds of *Rulingia, Commersonia, Abroma, Guazuma,* and of all the *Lasiopetaleæ* and *Hermannieæ*.

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* Mém. du Mus. x. p. 215. tab. 15. figs. 8, 9, 10, & 11.

From these several points of structure, it is evident that *Diclidanthera* bears little relation towards the *Ebenaceæ, Styraceæ,* or *Polygalaceæ,* as suggested by botanists; for though it has some features approaching the latter family, it is totally distinct from it in the great symmetry of all its parts and the structure of its stamens. The facts above described show its near affinity to *Büttneriaceæ*, among which family the genus *Philippodendron* presents many points of close analogy to that under consideration: it exhibits in an equal degree perfect symmetry in its parts; the monadelphous tube of the stamens is agglutinated to the corolla; its sessile anthers, double in number to the petals, burst transversely into two valves; a single ovule is suspended from the angle in the summit of each cell of the ovary; it has a simple style and a clavate stigma. The pedicels of the flowers of *Diclidanthera* also have each three very deciduous bracts at their base, and are articulated upon as many glands, as frequently observed in *Büttnerieæ*; and its liguliform petals exhibit the contorsive imbrication of their margins, which is so marked a feature in that family. We may further add to these points of approximation the analogy of its stipules, which offer so marked a feature in that order; they are present in *Diclidanthera,* although very deciduous, and they are accompanied by peculiar persistent glands. From the *Philippodendreæ,* through *Diclidanthera,* there is a more perfect transition-link between *Büttneriaceæ* and *Sterculiaceæ,* especially with the tribe *Myrodieæ,* with which our genus has several characters in common.

The following is an emended character of the genus, based upon my own observations:

Diclidanthera, Mart. Pluchia, *Vell.*—*Flores* hermaphroditi. *Calyx* in imo hemisphæricus et hinc cum *disco* cupuliformi carnoso adnatus, superne in *sepala* 5, linearia, obtusa, æqualia, utrinque pilosa, æstivatione quincuncialiter imbricata, decidua, divisus. *Petala* 5, æqualia, sepalis 2–3-plo longiora et alterna, margine disci enata, et ultra medium ad tubum staminiferum agglutinata, hinc pseudo-gamopetala, marginibus contorsive imbricatis, sinistris connatis, dextris liberis, ciliatis, et carinis totidem obliquis efformantibus, supra tubum omnino libera, apicem versus paullulo latiora, obtusa, subpatentia, æstivatione quincuncialiter imbricata. *Stamina* monadelpha, cum petalis orta, *filamenta* in tubum integrum, cylindricum, elongatum, tenuissime membranaceum, ad petala arcte agglutinatum, 10-nervem, coalita: *antheræ* 10, æquales, uniseriatæ, in marginem tubi filamentorum insertæ, erectæ (et ut videtur in fauce tubi corollæ sessiles), reniformi-ovatæ, 2-loculares, loculis collateralibus sine connectivo coalitis, transversim 2-valves, rima oblique hippocrepica dehiscentes, valva postica paullo majore erecta, antica hiante deflexa et e basi pendula. *Pollen* globosum, vittis 4 notatum, et transversim creberrime lineatum. *Ovarium* parvum, subglobosum, glabrum, stipitatum, obsolete 5-sulcatum, 5-loculare; *ovula* in quoque loculo bina (uno minore et effœto), ad axin centralem infra apicem suspensa, micropylo supero, raphide ventrali. *Stylus* simplex, pilosus, stamina excedens. *Stigma* parvum, clavatum, breviter 5-lobum. *Drupa* globósa, cupula parva calycina suffulta, sicca, coriacea, indehiscens, 5-locularis, 5-sperma, aut abortu 2–3-sperma. *Semen* suspensum, ovatum, compressum; *integumenta* 3, *extimum* fuscum, retrorsum pilosum, pilis albidis, sub lenti rugoso-punctatum, *intermedium* rubellum, nitidum, crassiusculum, vertice hilo notatum, basi chalaza signatum, *intimum* membranaceum. *Embryo* in *albumen* tenue, carnosum, paullo longius inclusus; *cotyledonibus* suborbicularibus, subcordatis, planis, foliaceis,

viridiusculis, albumini fere æquilatis, et paullo brevioribus, *radicula* brevi, tereti, supera, summum attingente.

Arbusculæ *Brasilienses intertropicæ,* ligno *duro rigido,* ramis *subsarmentosis,* ramulis *sæpissime pendulis;* folia *petiolata, integerrima, nitida, valde reticulata, glabra, in nervis puberula, glandulis paucis sæpe in dichotomiam nervorum immersis;* petiolus *in imo articulatus;* stipulæ *binæ, acutæ, deciduæ, utrinque e glandula umbilicata ortæ;* inflorescentia *racemosa;* racemi *folio breviores, in ramulis novellis axillaribus terminales, pluriflori;* flores *alterni breviter pedicellati;* pedicellus *breviusculus, e nodulo 3-tuberculato ortus, in imo articulatus et 3-bracteatus;* bracteæ *parvæ, acutæ, valde deciduæ;* corolla *ochroleuca, siccitate purpurascens;* fructus *cerasiformis.*

1. *Diclidanthera penduliflora,* Mart. Nov. Gen. ii. 140, tab. 196; Flor. Brasil. fasc. xvii. 11, tab. 4. fig. 1;—ramis pendulis, ramulis subpuberulis; foliis oblongis vel lanceolato-oblongis, utrinque acutis, supra lucidis, hinc ad basin petiolum versus 2-glandulosis, costa media inferne rufescente, glabris, utrinque valde reticulatis, petiolo tereti, pubescente; racemis in ramulis novellis terminalibus, folii floriferi fere longitudine; sepalis extus fere glabris, sub lente sparse retrorsum puberulis, corollæ glabræ ochroleucæ tertia parte longitudinis.—Brasilia tropica, ad fluv. Amazonas.—*v.s. in herb. meo,*—prope Santarem (Spruce).

Prof. Martius describes it as a tree 10 to 15 feet high, with loose pendulous and subscandent branches, the leaves being 4 to 6 inches long and 12 to 18 lines broad. In Spruce's specimen they measure 4 inches in length, and 15 to 17 lines in breadth, on a petiole 3 lines long. In the size of the tree, its habit, in the form of its leaves, their size and colour, this species is scarcely to be distinguished from the following one, the only valid specific difference being in the two basal glands constantly seen on the *upper* side of the leaf, at the point of junction of its blade with the petiole, which are always wanting in *D. laurifolia.* The corolla is a little more slender and rather longer in regard to the calyx, and when dried, of a brighter crimson colour; its pedicel is only half a line long; the sepals, which become reddish in drying, are 4 lines long and 1 line broad; the length of the corolla is 10 or 11 lines, including the border of 3 lines, the tube being only a line in diameter.

Var. *β. penæantha,* Mart. *loc. cit.* D. Martii, *Pöpp. MSS. in herb.* 2883;—"foliis brevioribus, latioribus, ovato-oblongis, basi subrotundatis, petiolis evidentius puberulis; racemis

depauperatis (2–3-floris) petiolo 2-plo longioribus; calycibus evidentius pubentibus."—Fluv. Amazonas, Ega (Pöppig).

This variety I have not seen. In the form of its leaves it seems to approach more to *D. elliptica;* but the presence or absence of the basal glands on the upper surface of the leaves will determine to which species it belongs. The shortness of its racemes, which are only half an inch in length, and its being only two- or three-flowered, if a constant character, would suggest the possibility of its being accompanied by other marked specific differences.

2. *Diclidanthera laurifolia,* Mart. *loc. cit.*;—ramis glabris, subscandentibus; ramulis subpendulis et puberulis; foliis elliptico- vel lanceolato-oblongis, utrinque subacutis, glaberrimis, valde reticulatis, margine cartilagineo rubello reflexo, supra nitidis, basi superne eglandulosis, subtus costa media rubella, sæpe in dichotomia nervorum glandula umbilicata instructis, petiolo tereti, pubescente; racemis in ramulis novellis terminalibus, folio subbrevioribus; sepalis utrinque puberis; corolla subglabra, ochroleuca, sicca purpurascente.—Brasilia, Prov. Rio de Janeiro.—*v. v.* ad Santa Theresa, in ascensu ad Montem Corcovadensem.

A tree about 15 feet high, with a habit quite as subscandent as the preceding species, and with its branchlets half-twining, half-pendulous: its leaves are from 2 to 3 inches long, 12 or 14 lines broad, upon a petiole 3 lines in length; they are hardly distinguishable in form and appearance from the former, and in both species they assume a reddish hue in drying; below they are of a pale green, with a reddish midrib and prominent anastomosing nervures. In this species more particularly, small round glands with an umbilicated centre are often, but not constantly, found immersed in the forked points of the nervures on the under side only of the leaf, and are never seen upon the upper surface as indicated in the preceding species. In both species the stipules are seen on each side of the insertion of the articulated petiole, linear, acute, erect, and half a line long, each springing out of a gland similar to those seen on the under side of the leaf. The racemes, which grow out of the extremities of the younger branchlets, are generally about 1½ inch long, with about eight to ten flowers placed alternately; the pedicel of each flower is a line in length, and proceeds from a prominent nodule formed of three confluent glands, which bear as many deciduous bracts, similar to those which support the stipules. The sepals are 4 lines long, 1 line broad, and retrorsely pubescent on both sides. The corolla is of a yellowish white (not white, as stated), which in drying becomes of a bright red colour: including the portions that form the border, which are 3 lines long and barely a line broad, it measures 9 lines. A singular peculiarity is observable in its æstivation:—the free margin of each petal, where the adherent portions form the tube, is turned in the same direction, showing a contorsive imbrication, while the free portions constituting the border are quincuncially imbricated in the bud. The exsuccous rugose drupe is about 8 lines in diameter, and is of a reddish colour when fresh, becoming fuscous brown when dry, and quite coriaceous, with chartaceous dissepiments. The suspended seeds, solitary in each cell, are covered with a white and almost woolly pubescence; they are 5 lines long, 3 lines broad, and 2 lines in thickness: the albumen is white and fleshy: the embryo is quite green, the cotyledons being orbicular, 2½ lines in diameter; its superior radicle, ¾ of a line long, nearly touches the summit.

3. *Diclidanthera elliptica*, n. sp. Pluchia curiosa?, *Vell. Flor. Flum.* vol. iv. tab. 20, text, p. 157;—foliis ellipticis vel late ovatis, apice subacutis et mucronatis, basi obtusioribus, utrinque pallide viridibus, valde reticulatis et subpuberulis (præsertim in costa media straminea, et in nervibus), margine vix reflexo, superne opacis, omnino eglandulosis, subtus rarius in dichotomiis nervorum glanduliferis, petiolo tenui, pubescente; racemis plurifloris, in ramulis novellis terminalibus, folio interdum longioribus; sepalis utrinque valde pubescentibus, corolla dimidio brevioribus, oblongis, obtusis; corolla fusciore subpuberula, marginibus petalorum in tubum longe ciliatis.—Brasilia.—*v. s. in herb. meo,*—Prov. Minas Geraës (Gardner, 5002); Iguassu, in Prov. Rio de Janeiro (filio meo lecta).

This is certainly a very distinct species, with quite a different aspect from the two former. It has scarcely the same scandent habit; the leaves are larger, broader in proportion, paler, greener, more dull on the upper surface when dried, and mucronate at the point; they are 3¾ inches long, 1¾–2 inches broad, on a petiole of 2½ lines; the midrib is of a pale straw-colour; they bear no basal glands on the upper surface, as in *D. penduliflora*, but they have similar glands on the nerval furcations, as in the last species. The racemes are similarly terminal, 1½–2 inches long, 10–15-flowered; the pedicels are 1 line long; the sepals 3 lines; the corolla rarely exceeds 6 lines in total length, the tube being only 4 lines long, broader than in the preceding species, and always of a dark fuscous red when dry, the margins of the limb being somewhat paler. The calyx, as well as the whole branchlet, is more densely pubescent, being almost tomentose.

The description given in the text of Velloz of his *Pluchia curiosa* corresponds better with this species than with the preceding one, to which it is referred by Prof. Martius. By Velloz it is placed in Octandria Monogynia: I have found it to happen occasionally, in all the species, that one or two of the anthers are deficient; but in that case the tube of the stamens is constantly 10-nerved*.

ADDITIONAL OBSERVATIONS UPON THE GENERA APTANDRA, CATHEDRA, LIRIOSMA, LERETIA, PORAQUEIBA, AND EMMOTUM.

APTANDRA.

IN completing the drawing to illustrate this genus, as described in this work (p. 3), I have been able to add the details since obtained of the structure of its fruit and seed. This information, which fixes beyond doubt the position of *Aptandra* in the system, is derived from the analysis of the only fruit that accompanied a specimen of the *Heisteria tubicina* of Pöppig, which I received from Mr. Spruce. This plant is described by Pöppig in his 'Nov. Gen.' iii. 35, and is figured by him in plate 241, but only from immature fruit. We have satisfactory proof that it really belongs to *Aptandra* by the presence of an ovary in the same specimen, which is somewhat advanced in growth, and around the style of which the peculiar monadelphous staminal tube still remains, which is precisely similar to that I have shown in *Aptandra Spruceana*. The calyx, which in the flower is barely a line long, in the fruit grows to a very large size, becoming campanular with an entire spreading mouth, and it half envelopes the dry globular drupe, which is nearly an inch in diameter. Its pericarp is smooth, coriaceous, indehiscent, half a line in thickness, unilocular, and monospermous: the nucleus, in this instance, was greatly shrivelled, and in consequence much corrugated, and was covered with mildew, so that the nature of its decayed seminal envelopes could not be ascertained: a firm integument adhered closely to the pericarp, which appeared to me to be the external tunic of the seed rather than of the endocarp; but of this I cannot be sure: the nucleus adhered to the bottom of the cell by a round cicatrix, which appears to be the remnant of the free central placenta, upon which the ovules are attached in the floral ovary. The nucleus consisted of a homogeneous fleshy substance, which, after being well macerated and cut open transversely, showed no signs of any embryo; but in its centre was a large vacuity, the sides of which were pressed together by the shrinking of the mass: this vacuity presented a very polished surface; and from it several rays branched towards the circumference, leaving so many fleshy wedges between the radiating spaces; near the summit these spaces terminated in one point, and in the solid part above this I discovered with some difficulty a very minute embryo, about half a line in diameter, consisting of two distinct, orbicular, flat, foliaceous cotyledons, with a notch on the margin for the insertion of the radicle, which was unfortunately lost in its extraction; but the polished indentation of the entire embryo, left in the substance of the albumen, indicated its shape and relative size in regard to the cotyledons. The evidence of this structure is therefore nearly complete. In the diminutive size of the embryo, imbedded in the summit of the albumen, this structure quite agrees with that of *Heisteria* and other genera of the *Olacaceæ*; and it may be further remarked that I have observed in the albumen of *Heisteria* and *Liriosma* a constant large vacant space, running from its base up its centre, and terminating in the more solid part below the summit, in which the small embryo is imbedded.

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* A drawing of this species, together with analytical details of the structure of the flower and seed of *Diclidanthera laurifolia*, is given in this volume, Plate 32.

From the structure of the ovary, fruit, and seed, combined with other characters, it is manifest that *Aptandra* is nearly allied to the *Olacaceæ*, agreeing with that order in the form and æstivation of the calyx and petals. The singular enlargement of the calyx, which ultimately half envelopes the fruit, occurs in a very similar manner in *Olax*, *Heisteria*, and some other genera; but *Aptandra* is very distinct from every genus of that family in the remarkable confluence of the stamens into a long, thick, monadelphous tube, which embraces the style, and bears a number of extrorse anther-cells, adnate below its summit, just as in *Canellá*, but which burst by the deflection of their outer valves, as in *Diclidanthera*.

This striking pèculiarity might well claim the right of *Aptandra* to be the type of a distinct family allied to *Olacaceæ*; but I will not venture to propose it until other analogous genera are discovered: in the meantime it may remain as a suborder of that family, bearing the name of *Aptandreæ*.

To the generic characters of *Aptandra*, as before given (p. 2), we may therefore now add:—

Drupa magna, sicca, globosa, calyce persistente aucto cupulari laxe semicincta, *pericarpio* coriaceo indehiscente, 1-locularis, 1-sperma. *Semen* imo loculi affixum; *integumenta* ignota; *albumen* copiosum, carnosum, a basi ultra medium radiatim

excavatum; *embryo* parvus, in illo summum versus sepultus, *cotyledonibus* orbicularibus, valde foliaccis, *radicula* brevi tereti supera 4-plo longioribus.

1. *Aptandra Spruceana,* huj. op. p. 3. plate 1; Ann. Nat. Hist. 2nd ser. vii. p. 202.

2. *Aptandra tubicina,* Bth. MSS.—Heisteria tubicina, *Pöp. Nov. Gen.* iii. 35. tab. 241;—foliis ellipticis, apice repente lineari-attenuatis, utrinque glabris, subtus ferrugineo-punctulatis, rachi nervisque anastomosantibus lævibus et rubellis, venis valde reticulatis; paniculis axillaribus, petiolo 4-plo longioribus, folio 7-plo brevioribus, pedicellis in fructu elongatis et incrassatis, in flore capillaribus; drupa globosa, calyce aucto laxe campanulato semi-inclusa.—Prope Panurè, Rio Uaupès, in Brasilia Septentr. (Spruce, 2741).

This is described as a short tree with lax branches; the axils are about 1½ inch apart; the leaves are 5½ inches long and 2 inches wide, upon a petiole 3 lines in length. The inflorescence is about ¾ inch long; the pedicels, which are capillary in flower, become thickened in fruit, especially towards their summit, and are upwards of an inch in length; the antheriferous tube, which I have represented in the drawing, exactly resembles that of the preceding species. The fruit is described in a preceding page.

3. *Aptandra Benthamiana,* n. sp.;—ramulis fuscis, angulatis; foliis ellipticis, versus summum gradatim angustioribus, apice angusto et rotundato, utrinque opacis, lurido-fuscescentibus, coriaceis, crassiusculis, nervis omnino immersis et vix distinguendis, margine undulato incrassato haud reflexo; paniculis in apicibus ramorum axillaribus, late ramosis, folio dimidio brevioribus; floribus parvulis, numerosis, pedicellis longissimis, capillaribus.—Prope San Carlos, Rio Negro, Brasilia Septentr. (Spruce, 3000).

Its leaves are 3 inches long and 1 inch broad, on a terete petiole 5 lines in length; the inflorescence is 1 inch long, 1½ inch broad, the capillary pedicels measuring 6 lines.

4. *Aptandra liriósmoides,* Spruce MSS., n. sp.;—foliis oblongis vel lanceolato-oblongis, imo obtusis, apice subattenuatis, obtusiusculis, et mucronulatis, glaberrimis, superne opacis, fusco-viridibus, inferne e punctulis numerosissimis cinereo-albescentibus, margine ferrugineo; nervis sese intra marginem arcuatis, tenuiculis, utrinque parce prominulis, rachi superne sulcato et albido, subtus prominente; paniculis late ramosis-

simis, folio tertio brevioribus; floribus parvulis, pedicellis capillaribus.—Prope Panurè, Rio Uaupès, Brasilia Septentr. (Spruce).

The axils of the branches are shorter than in the other species, being from ¼ to ¾ inch apart; the leaves are 2½ inches long and 11–12 lines broad, on a petiole 3 lines in length: the inflorescence is ¾ inch long, spreading to an inch in breadth; the delicate pedicels are 7 lines long, the flowers in bud being 1¼ line in length.

CATHEDRA.

This genus has been described in p. 9 of this volume and in Ann. Nat. Hist. (2nd ser. vii. 452); and the *Diplocrater* of Mr. Bentham (Kew Journ. Bot. iii. 367) does not appear to me to differ from it. Throughout the *Olacaceæ* there is a general disposition to a vast increment of the calyx, as in *Olax, Heisteria,* and *Liriosma*; in *Schöpfia* it is the disk that enlarges and becomes adnate to the fruit; but in *Cathedra* not only a considerable growth takes place in both the calyx and the disk, but generally one, and sometimes two of the cupuliform bracts, at first scarcely distinguishable, suddenly swell rapidly after the fall of the corolla, and the growing ovarium thus becomes surrounded by 3 or 4 distinct free cups, which are more or less concentric or superimposed. The ripe fruit is not known; but I have represented in Plate 2 the appearance of these disks when the ovary has attained ten times the size it had at the period of the fall of the corolla. I now add the details of two other species from Spruce's collections:—

1. *Cathedra rubricaulis*, nob., huj. op. p. 14. pl. 2; Ann. Nat. Hist. 2 ser. vii. 458; Corcovado, Rio de Janeiro.

2. *Cathedra Gardneriana*, nob., loc. cit.

3. *Cathedra acuminata.*—Diplocrater acuminata, *Benth. Kew Journ. Bot.* iii. 367;—ramis glabris, striatellis, ramulis floriferis virgatis, fusco-pruinosis, sub lente brevissime hirtellis; foliis oblongo-ellipticis, summo abrupte attenuatis, acutis, utrinque glabris, submembranaceis, subtus brunnescentibus; nervis paucis, paullo prominentibus, reticulatis, petiolo tenui, subbrevi; floribus minimis, axillaribus, paucis, fasciculatis, breviter pedicellatis.—Barra do Rio Negro, Brasilia Septentr. (Spruce, anno 1850–1851).

A tree 15–20 feet in height; the internodes of the branchlets are 1–1½ inch apart; the leaves are 3½–4 inches long, 1¼–1½ in. broad, on a petiole 3 lines in length: about 3–6 flowers in each axillary fascicle; pedicels equal to the length of the flower, only ¼ line; disk equal in size to the calyx, both cupuliform; petals 6.

4. *Cathedra crassifolia*, Benth. MSS.;—ramulis glabris, cortice rimoso; foliis oblongo-ellipticis, utrinque acutis, apice anguste attenuatis, subcoriaceis, utrinque opacis et rugulosis, nervis paucis superne immersis, subtus vix prominulis, margine reflexo; floribus paucis, axillaribus, fasciculatis, e nodo prominente ortis.—Fluv. Guainia et Casiquiare, Brasil. Septentr. (Spruce, 3514).

Its leaves are 3½ inches long, 1¼ in. broad, on a petiole 4 lines in length. The flowers are 1½ line long, on a pedicel of 1 line.

LIRIOSMA.

I have enumerated four species belonging to this genus of the *Olacaceæ*, to which five others are now added.

1. *Liriosma candida*, Pöp. Nov. Gen. iii. 33. tab. 239.
2. *Liriosma pauciflora*, A. DC. Prodr. viii. 673; Deless. Icon. v. tab. 41; Ann. Nat. Hist. 2 ser. viii. 106, cum synon.—Bahia (Blanchet);—foliis obovatis, imo obtusis, gradatim acutis, glaberrimis, crassiusculis, utrinque pallide viridibus, supra subnitidis, nervis hinc prominentibus, subtus omnino immersis, margine vix reflexo: 2¼ poll. longis, 1¼ poll. latis.—Bahia (Moricand, 2593).
3. *Liriosma Gardneriana*, A. DC. loc. cit.; Ann. Nat. Hist. 2 ser. viii. 108, cum synon.; huj. op. p. 19. pl. 3.—Prov. Ceará Brasiliæ (Gardner, 1537).
4. *Liriosma Velloziana*, A. DC. loc. cit.; Ann. Nat. Hist. l. c. 107, cum synon.; huj. op. p. 20. pl. 3.—*Dulaccia singularis*, Vell. Flor. Flum. p. 32, et vol. i. tab. 78.—Rio de Janeiro.
5. *Liriosma pallida*, n. sp.;—foliis oblongis, gradatim angustioribus et longe acuminatis, membranaceis, utrinque pallidis, glaberrimis, reticulatis, petiolo brevi; racemo axillari, brevi, sub-6-floro; pedicello calyce corollaque puberulis.—Prope Panurè, Rio Uaupès, Brasil. Septent. (Spruce, 2572).

Its branches and branchlets are slender; the pale leaves, of very thin texture, are 2 inches long and 8 lines broad, on a narrow petiole that does not exceed a line in length: the racemes are 5 or 6 lines long, the pedicels are 1 line long, and the flower in bud 2 lines in length; they are somewhat secund.

6. *Liriosma inopiflora*, n. sp.;—foliis ellipticis vel ovatis, imo subacutis, apice obtusatim attenuatis, et mucronulatis, sub-

coriaceis, utrinque glaberrimis, supra nitidis, in nervis sulcatis, subtus pallidioribus, glauco-lividis, concavis, nervis paucis brevibus sese arcuatis, margine cartilagineo reflexo, petiolo brevi, glabro, transverse rugoso; racemulis brevissimis, axillaribus, floribus 2–3, rarius pluribus, subsecundis, rachi pedicellisque puberulis, calyce et corolla glabris; drupa ovali, apice umbilicata.—Prope San Carlos, Rio Negro, Amazonas (Spruce, 3487).

A species allied to *L. pauciflora*, but with much shorter racemes and smaller flowers; its leaves are much darker, thicker, more opaque beneath, more acute at base, all (even younger ones) quite glabrous, excepting along the midrib above; nervures shorter, more spreading; calyx and corolla smooth; branchlets virgate, of a golden-yellow colour and puberulous: its leaves are 3½ inches long, 1¼ inch wide, the petiole being 1½ line in length; the racemes are 4 lines long, the pedicels 1 line, the flowers before opening 2 lines long; the drupe is 8 lines long and 5 lines in diameter.

7. *Liriosma ovata*, n. sp.;—foliis late ovatis, imo obtusis, prope summum attenuatis, hinc obtusis et emarginatis, crassiusculis, supra lucidis, subtus opacis, fuscis, utrinque glabris, nervis paucis sese arcuatis breviter divergentibus omnino immersis, subtus vix visibilibus, margine tenui reflexo, costa mediana superne pubere, subtus glabra, sulcata, petiolo brevi ruguloso; racemulis brevibus axillaribus glabris, 4–6-floris, floribus minoribus, glabris.—Barra do Rio Negro, Amazonas. (Spruce, in flore, sine numero, coll. 1850–51; in fructu immaturo, No. 1366).

In this species the leaves are 2¼–2¾ inches long, 1⅜–1⅝ inch broad, on a petiole 2 lines in length; the racemes are 3 lines long.

8. *Liriosma acuta*, n. sp.;—ramulis virgatis, strictis, glabris, striatis; foliis distantibus, oblongis, imo valde obtusis, infra medium versus summum gradatim acutis, acuminatis, concoloribus, subpallidis, utrinque opacis, supra glabris, subconvexis, nervis immersis, subtus sub lente sparse puberibus, nervis prominulis, reticulatis, margine tenui revoluto, junioribus minoribus et utrinque viridibus, petiolo brevi; racemulis axillaribus, brevibus, paucifloris. — Rio Negro, Amazonas (Spruce, 1508).

The branchlets are long and virgate, the internodes about 1 inch apart; the leaves 3–4 inches long, 1⅜–1⅝ inch broad, on a petiole 2 lines long: the floral racemes, in my specimen, are

in a very young state; they are only 3 lines long, both in flower and fruit. The drupe, supported on a very short pedicel, is 11 lines long and 7 lines in diameter; the sarcocarp, in a dried state, is very thin; the putamen is also very thin, marked externally and internally by nine longitudinal lines; the integuments are membranaceous; the albumen is very thick and fleshy, marked by three longitudinal grooves, which terminate at the base in three short hollow spaces, uniting in a long hollow cylindrical cavity in the axis which extends to ¾ of the length of the albumen; in the solid apex, over this space, the minute embryo is imbedded; the radicle is superior, short, thick, and clavate; the cotyledons are of equal length, but much thinner and narrower.

9. *Liriosma macrophylla,* Bth. MSS.—Olax macrophylla, *Bth. Trans. Linn. Soc.* xviii. 678;—ramulis glabris, striatis; foliis lanceolato-oblongis, utrinque acutis, summo gradatim acuminatis, acutissimis, textura tenui, ubique glaberrimis, superne sublucidis, subtus pallidioribus, opacis, nervis paucis sese arcuatis breviter divergentibus, paullo prominentibus, reticulatis, rachi subtus prominulo et sulcato, margine valde reflexo, petiolo brevissimo, crassiusculo, transverse ruguloso; racemis axillaribus, 6–10-floris.—Rio Casiquiare, in Brasilia Septentrionali (Spruce, 3312).

The leaves are 5½–5¾ inches long, 2½–2¾ inches broad, on a petiole of 2 lines; the raceme is 3–4 lines long; the drupe is 9 lines long, 5 lines in diameter, supported on a pedicel 2 lines in length.

To some of the genera of the *Icacinaceæ* formerly described I have to make the following additions:—

LERETIA.

1. *Leretia Vellozii,* nob., Ann. Nat. Hist. 2 ser. ix. 392; huj. op. p. 62. pl. 7.—L. cordata, *Vell. Flor. Flum.* iii. tab. 2.—Rio de Janeiro.

2. *Leretia ampla,* n. sp.;—ramulis angulatis, glaberrimis, cortice laxo, rugoso; foliis majusculis (floralibus minoribus), oblongis, imo obtusis, e medio gradatim acutis, mucronatis, submembranaceis, utrinque glaberrimis, subnitidis, pallescentibus et concoloribus, nervis conspicuis obliquis sese arcuatis subtus prominentibus, valde reticulatis, venis transversalibus, margine integro, petiolo rubro, tereti, striato; paniculis laxis, folio brevioribus, infra axillas oppositifoliis, vel terminalibus,

valde ramosis, multifloris, vix pubescentibus; floribus minoribus, petalis extus adpresse pilosis, intus breviter cottonco- et incano-tomentosis.—Prope San Carlos, Rio Negro, Amazonas (Spruce, 3776).

Its leaves are 8½ inches long, 3¾ inches broad, on a petiole ½ inch in length; the floriferous leaves are only half this size, or still smaller. The very branching inflorescence is 2½ inches broad, as well as long; the flowers in bud are somewhat globose, 1 line in diameter, on short pubescent pedicels.

3. *Leretia nitida*, n. sp.;—ramulis angulatis, glabris, lenticellis notatis; foliis ellipticis, utrinque acutis, summo attenuatis et hinc interdum obtusis, crassiusculis, ubique glaberrimis, supra intense viridibus, nitidis, infra pallidioribus, nervis obliquis sese arcuatis, infra prominulis, valde reticulatis, margine reflexo, petiolo subbrevi, canaliculato; paniculis axillaribus et terminalibus folio dimidio brevioribus, fulvo-pruinosis, petalis extus pruinosis, intus pilis longis ferrugineo-sericeis donatis. Rio Negro, Amazonas (Spruce, 1528).

Its leaves are 5 inches long, 1¾ inch broad, on a petiole 3 lines in length. The inflorescence is 2 inches long, spreading to a breadth of 1½ inch; the flowers in bud are 1½ line long, on pedicels of ½ a line in length.

PORAQUEIBA.

When the structure of this genus was described (huj. op. p. 71; Ann. Nat. Hist. 2 ser. ix. 482), I had not been able to detect any apparent dehiscence of the anther-cells: those in the species of which the diagnosis is given below, were, however, sufficiently ripened to show their mode of opening. I find that in each of the four distant cells a rupture takes place, by one of its margins, along the line of its junction with the connective, as has been correctly described by M. Tulasne, and nearly in the manner I have shown to occur in *Emmotum* (*loc. cit.* x. 177). This genus must therefore be referred to the tribe *Emmoteæ* (*loc. cit.* ix. 223). To the generic diagnosis of *Poraqueiba*, as above cited, we must add, to the description of the anthers—

loculis singulatim margine unico a connectivo soluto, hinc rima longitudinali lateraliter dehiscentibus.

1. *Poraqueiba Guianensis*, Aubl., Ann. Nat. Hist. 2 ser. ix. 483; huj. op. p. 71.—Guiana Gallica.

2. *Poraqueiba Surinamensis*, nob., ibid. p. 483; huj. op. p. 72. tab. 10.—Surinam.

3. *Poraqueiba sericea,* Tulasne, ibid. p. 484; huj. op. p. 72.—Ega, Amazonas.

4. *Poraqueiba acuminata,* n. sp.;—ramulis cylindricis, tomentillis; foliis ovatis, basi rotundatis vel truncatis, apice subito acuminatis, crassis, coriaceis, superne nitidiusculis, subtus flavido-pruinosis, nervis supra omnino immersis, subtus prominentibus, parallele obliquis, ad marginem vix revolutum arcuatim nexis, venis transversis reticulatis, rachi supra sulcato, subtus valde prominente, petiolo longo crasso canaliculato; racemis axillaribus folio tertio brevioribus, rachi crasso, ramis crassiusculis distantibus, brevibus, divergentibus, floribus fere sessilibus, hinc agglomerato-spicatis.—Barra do Rio Negro, Amazonas (Spruce, 1748).

This species is distinguished by its thicker and more coriaceous leaves, with their underside and nervures thickly covered by a densely pruinose covering; the nervures above (about eight on each side) are wholly immersed and smooth above, extremely prominent and thick beneath; the main peduncle of the inflorescence is much thicker, and the flowers are perfectly sessile. The leaves are 8–10 inches long, 4½–5¾ inches broad, the petiole being 1 inch long and ⅛ inch thick: the raceme is 2¾ inches long; its thick branchlets are 6–10 lines long, diverging at nearly a right angle: the flowers, at the period of bursting, are 1½ line long.

EMMOTUM.

To this genus I am enabled to add only partial details of its carpological structure, derived from an examination of Spruce's specimen (No. 1989) of *Emmotum acuminatum,* with which I received a single fruit. This is a drupe of a depressed globular form, 8 lines in diameter, its vertical axis being 5 lines long; its coriaceous sarcocarp, about ⅛ inch thick, covers a rugose osseous indehiscent nut of about the same thickness; the latter is 5-celled, three or four of these cells being much smaller, and evidently semi-abortive; the other cell contained no seed, nothing remaining within but the dried and shrivelled integuments.

1. *Emmotum orbiculatum,* nob., Ann. Nat. Hist. 2 ser. x. 178; huj. op. p. 108.—Pogopetalum orbiculatum, *Benth. Linn. Trans.* xviii. 685. tab. 42.—In Brasilia Septentrionali.

2. *Emmotum acuminatum,* nob., loc. cit. 178; huj. op. p. 108. tab. 21 B.—Pogopetalum acuminatum, *Benth. loc. cit.* 685.—Rio Negro Brasiliæ.

3. *Emmotum fagifolium*, Desv. in Ham. Prodr. 29; nob., loc. cit. p. 179; huj. op. p. 189. tab. 21 A.—Pogopetalum acutum, *Benth. in Hook. Lond. Journ. Bot.* ii. 377.—Guiana Gallica.

4. *Emmotum affine*, nob., loc. cit. 180; huj. op. p. 110.—Pogopetalum affine, *Planch.*—Brasilia (Sellow).

5. *Emmotum nitens*, nob., loc. cit. 180; huj. op. p. 110. tab. 22 A.—Pogopetalum nitens, *Benth. loc. cit.* ii. 377.—Brasilia intertropica.

6. *Emmotum glabrum*, Bth. MSS.;—foliis ellipticis, utrinque acutis, apice longe attenuatis, glaberrimis, subcoriaceis, supra fusco-viridibus, subtus pallide ferrugineis, margine revoluto, nervis omnino immersis, lineis striatis transversis interruptis creberrime parallelis utrinque insculptis, costa media rubella, margine revoluto, petiolo canaliculato; paniculis brevibus, petiolo 2–3-plo longioribus, pedunculo pedicellisque pubescentibus, corolla et calyce glabris, hoc dentibus ciliatis, petalis lanceolatis, carina interna dense lanatis.—Rio Guainia et Rio Casiquiare in Brasilia Septentrionali (Spruce, 3536).

The leaves are 3¾ inches long, 1½ inch broad, on a petiole 3 lines in length; the racemes are 6–9 lines long, the flowers in bud 1½ line long; the petals are clothed internally with dense silky long hairs, springing from the prominent keel; the stamens are somewhat shorter than the petals; the filaments are compressed and glabrous; the two cells of the anthers are separated, and fixed upon the margins of an obcordate connective; the ovary is densely clothed with adpressed white sericeous hairs, surmounted by a glabrous style of equal length*.

ON THE TRIBE COLLETIEÆ, WITH SOME OBSERVATIONS ON THE STRUCTURE OF THE SEED IN THE FAMILY OF THE RHAMNACEÆ.

THIS tribe differs from others of the *Rhamnaceæ* in having always opposite branchlets usually terminating in acute spines, while in most Rhamnaceous genera they are alternate; for, though they sometimes approximate in pairs, they are never exactly opposite: the same may be said of their leaves. The *Colletieæ* also differ in the position of their petals and stamens, their insertion being always perigynous upon the tube of the calyx at some distance from the hypogynous disk, which in *Colletia* assumes a perigynous form: in this respect we meet with only one exception, in *Adolphia*, where, owing to the extreme shortness of the calycine tube, their point of attachment is drawn close to the disk; but, although thus brought into proximity, they are not actually inserted upon its margin, as they are generally in the *Rhamneæ*. In the tribe *Gouanieæ*, so different in most other respects, the insertion of the petals and stamens is like that of the *Colletieæ*. The stamens are placed opposite to as many scale-like petals in all the *Rhamnaceæ*; they are generally concealed and hooded by them in the *Colletieæ*, and are inserted upon their claws, between the lobes of the calycine border; the petals are, however, sometimes wanting, and in a single apetalous species the insertion of the stamens is below the middle of the tube. The *Colletieæ*, besides, are generally distinguishable at a glance by their peculiar habit: the branchlets, half abortive, often assume the form of spines, which are either quite bare, or they are foliiferous, or else they become more elongated, bearing both leaves and flowers, but sometimes they are destitute of both, with a broom-like appearance; the leaves, when present, are always small and opposite, or, by the approximation of the axils, almost fasciculated, and are either entire or denticulated, and sometimes are reduced to almost obsolete proportions. Most of the species at present known are natives of South America; there are a few in Mexico, one from the Galapagos, one from the island of Juan Fernandez, one from Australia and Tasmania, and another from New Zealand. There has hitherto been much confusion among the genera, the characters of many of them being still undefined: thus *Trevoa* and *Talguenea*, which I proposed above thirty years ago, have been confounded together by most botanists. My observations, I hope, will enable me to define the characters and limits of these as well as the other genera of the tribe.

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* A drawing of this species, with analytical details, is given in this volume, Plate 22 B.

When Jussieu published his 'Genera Plantarum' (in 1789), the only genus then known of the present tribe was *Colletia*; it was there placed in his order *Rhamni*, a heterogeneous group composed of *Rhamnaceæ*, *Celastraceæ*, *Aquifoliaceæ*, *Bruniaceæ*, *Staphylaceæ*, and some other genera. From this association Mr. Brown (in 1814) separated the *Celastraceæ*, including the *Aquifoliaceæ*, and (in 1818) the *Bruniaceæ*; and thus circumscribed, DeCandolle (in 1825) published an enumeration of the order, wherein *Colletia* appears as the only genus belonging to the tribe since constituted. We owe to Brongniart (in 1826) the best monograph of the family that has yet been published, where its affinities are well discussed, and where ample characters of the genera are given: here he first separated *Retanilla* from *Colletia*, and at that time he was able to muster only seven species in these two genera. Subsequently to that period, the number of plants belonging to the *Rhamnaceæ* have become greatly multiplied, and the characters of the species better known; several new genera have been established, but no regular enumeration has appeared since that of Brongniart above mentioned, so that a proper monograph of the order has become a great desideratum. It seems that Reissek (in 1840) was engaged in this important task; but his promised monograph, after a lapse of twenty years, has not yet made its appearance. Endlicher, in the same year, however, adopted the arrangement of Reissek, and accordingly, in his 'Genera Plantarum,' divided the family into six tribes, the *Colletieæ* being one of them, which there comprehends six genera.

Before I proceed to arrange my own observations, I will offer a few prefatory remarks upon many points of structure that I have met with in this family, and which do not appear to have been noticed. These developments I have found in all the species of the *Colletieæ* that have come under my scrutiny; they are constant in the *Gouanieæ*, and have been observed in many genera of the *Rhamneæ*; but I have not attempted a general examination of the whole order, as this required more time than could be devoted to it, and would have drawn my attention from other investigations in which I have been long engaged.

The fruit in all the genera of the *Colletieæ* is polycarpous, the normal number of its cells being three, rarely four: these are sometimes reduced to two, even in the ovary; and if the fruit be occasionally monospermous, as often occurs in *Trevoa, Colletia*, &c., the vestige of each abortive cell is always distinctly visible. The ovules are invariably solitary in each carpel, always erect, and fixed in the bottom of each cell; the radicle of the embryo constantly points to the hilum.

The seeds throughout the whole tribe of the *Colletieæ* present the same features; and as there are many curious circumstances connected with their structure, those of *Colletia dumosa*, collected by me in Chile thirty-five years ago, are selected as an example. They are of an oval form, about 1½ line long, 1 line in diameter, sometimes slightly compressed, often with an obsolete ridge on the ventral face, which has been mistaken for a raphe; erect; with a very hard polished outer surface, appearing finely granulated when magnified: this outer coating is corneous in texture, becoming softer by long maceration, when it may be cut through with a sharp knife; it is somewhat translucent, but rendered densely black by the lining that adheres to it; at its base, in a transverse direction in regard to the fruit, is seen a long furrow, or compressed bilabiate slit, which is always pervious. This outer shell is uniform in thickness, homogeneous in texture throughout, and under the microscope is seen to be composed of numerous narrow, transverse, hyaline cylinders, apparently solid, of equal size, all placed in a direction radiating from the centre of the seed; so that when the shell is viewed through either of its faces, it appears like a reticulation of minute hexagonal cells, each cell corresponding to the end of a long cylinder: by continued maceration, these cylinders may be separated from each other; it is clear, therefore, that in this organization there is not the slightest approach to any longitudinal vascular continuity. For reasons to be shown presently, we may infer that this shell is not one of the ordinary integuments developed from any of the original tunics of the ovule, but of posterior growth, and therefore not a testa, as hitherto supposed: it is a production apparently analogous in its structure to the outer tunic formerly described in the seeds of *Cucurbitaceæ**.

Within this shell, and adhering to it, is a second tunic, which is membranaceous, and agglutinated to it by means of a thick layer of cellular deposit of spongiose texture, brittle when dry, and so loosely aggregated that, when removed and soaked in water, and then slightly touched, these cells separate into distinct globules of a hexagonoid shape, and of a deep crimson colour. In the substance of this second membranaceous tunic is observed a white cord, which rises from the bottom, originating in one of the angles of the basal pervious chink, runs up one side of the tunic, crosses its summit without interruption in its course, and passes down the contrary side, terminating in the opposite corner of the basal perforation, and thus making a complete peripherical circuit round the inner surface that lines the shell. This cord is composed of a number of delicate spiral threads, so free that each fibre is easily drawn out separately. In some genera of the *Rhamnaceæ* (as in *Zizyphus, Alphitonia,* &c.), this second tunic is perfectly free from the outer corneous shell, a considerable space existing between them, in which is generally found a small quantity of very lax white cellular tissue. A third integument, although free from it, fills the space in the upper moiety of the last-mentioned coating in *Colletia,* but a little below the middle it becomes gradually narrower, more opake, and of a thicker texture, until it tapers into a short stout thread, that terminates in the basal perforation of the outer shell. The opposite extremity, or summit, is marked with a dark fleshy disk, like a chalaza, of nearly its own diameter. These integuments closely invest the albumen, which is fleshy, homogeneous in texture, and of considerable thickness on the ventral and dorsal faces, but becomes very thin round the margins of the cotyledons, the whole mass being of a roundish oval shape, suddenly contracted at its base into a prominent nipple, which is enclosed within the rostellated neck of the investing integuments before described; the embryo is nearly the size of the albumen, and much flattened, the cotyledons being oval, foliaceous, and fleshy, slightly cordate at the base, where they are united by a short cylindrical radicle, one half of which lies within the sinus, the other half in the nipple of the albumen; the cotyledons are anterior and posterior in regard to the axis of the fruit.

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* Trans. Linn. Soc. xxii. 92 & 108. More extended observations upon the seeds of different *Cucurbitaceæ* have led me to modify the inference made in that stage of the inquiry (*loc. cit.*), that the more external covering (there described as formed of three several portions) consists of epiderm, mesoderm, and endoderm—terms incorrectly applied to parts evidently distinct in their origin. The outer very thin stratum of that fleshy covering is reticulated with long hexagonoid cells, and its origin may be traced to an extension of the outer membrane of the funicle; the intermediate soft substance is a collection of lax fleshy cells intermixed with numerous araneiform filaments, all probably emanating from the fleshy substance of the funicle. In many genera this fleshy parenchymatous substance is entirely wanting, so that the shell of the seed is covered simply by the abovementioned thin pellicular membrane. In the centre of the funicle a thick cord of vessels is seen, which, as it approaches the seed, is observed to bend towards one side, and to enter one of the ends of the linear basal slit of the hard tunic; there is no appearance of its bifurcation at that point, as the vessels of the funicle appear to be immediately connected with only one of the two extremities of the peripherical raphe, which meet together in the base of that tunic. This hard crustaceous shell, usually called the testa, presents no sign of any organic connexion with the two layers of structure before mentioned, nor with the more internal tunic. The existence of a small thickening or chalazal spot on the summit of the inner integument, and of another round its contracted basal neck, is constant in all the seeds I have examined. The raphe is invariably peripherical, and undisturbed in its course by the apical chalaza, which it crosses: it is also free from the shell in all parts, except at its two basal extremities, which are both imbedded in channels formed in the crustaceous thickening of the shell around its base; but one of these extremities only, as just said, appears to be a continuation of the cord of the funicle. The imbedding of the two extremities of the raphe in a crustaceous deposit in the base of the shell is analogous to the structure observed in many genera of the *Rhamnaceæ*.

The presence of the distinct external crustaceous shell, always more or less pervious at the basal extremity (or one of its sides), and the position of the raphe, as above described, attached to an intermediate integument, making nearly a complete circle round the seed,—are features that occur not only in all the *Colletieæ,* but in all the genera of the *Rhamnaceæ* that I have examined, though subject to several modifications, which I will mention. In *Rhamnus catharticus,* however, as well as in *R. Alaternus* and a few others, the raphe, though still peripherical, is differently situated, for it is everted yet further from the position mentioned in *Colletia*; it is seen upon the dorsal face of the seed,—a well-known occurrence, that has been ingeniously accounted for by Mr. Bennett*; but before we adopt his conclusion, it is desirable to investigate the circumstances attendant on the phænomenon. Mr. Bennett says that he has universally found, throughout all *Rhamnaceæ*, that the ovules, in their early state, uniformly exhibit a ventral raphe; and hence he infers that any variation subsequently observed in its relative position, whether it be shifted to one side or round to the dorsal face, must be due to a simple twisting of the funicle, by which the ovule is turned upon its axis, either to the extent of a quarter or of half a revolution. Were this explanation required only in the case of the raphe becoming dorsal, we could scarcely refuse our assent to it, because in that case it appears to solve the difficulty with apparent satisfaction, notwithstanding that Mr. Bennett confesses his inability to assign any cause for so singular a rotation of the ovule.

The first point to be considered is the soundness of the foundation of the argument, that at the period of its fertilization the ovule has its raphe directed to the ventral side, and that it subsequently turns away from it by a lateral torsion of its funicle. Mr. Bennett states (*loc. cit.* p. 131) that he has invariably found this to be the case in the *Rhamnaceæ*; and this statement has been accepted as an indisputable fact by nearly all botanists. Some few, however, have ventured to cast a doubt on the subject: Mr. Clarke† says he has always found the raphe dorsal or lateral in that family from an early period; while Prof. Agardh affirms the reality of this latter circumstance, and protests in positive terms against the prevalent belief on this subject ‡; in his work above referred to, he gives a figure as an example of the structure (plate 15. fig. 5) where the raphe is turned away from the axis of the ovary prior to its impregnation. My own observations upon this point, though limited, certainly favour the latter view; for I have found, in repeated examples of *Rhamnus chlorophorus* where the raphe in the ripe seed is half lateral, half dorsal, that, in its unimpregnated ovule, it occupies exactly the same position: had there been any previous pivoting round upon its funicle in this case, the micropyle would have been turned away from the point necessary to its fertilization, and the funicle would consequently have intervened between the foramen of the ovule and the impregnating point protruding from the placenta; but I found, on the contrary, that the micropyle is placed over the fascicle of stigmatic tissue, evidently in its normal and proper position. Another confirmation of the same view occurs in *Rhamnus Alaternus*, where, in the ripe seed, the raphe is exactly dorsal, as in *R. catharticus*: here I found the unimpregnated ovule having its raphe precisely in the same position as in the seed, with its micropyle placed over the impregnating point of the placenta, and situated between the funicle and the axis of the ovary, proving that in this case there had been no twisting of the funicle, and consequently no pivoting of the ovule. I have also examined the living ovary of *Rhamnus catharticus* in an extremely young state, long before the ripening of the anthers, and therefore prior to its impregnation, and I have found the raphe most distinctly upon the dorsal face, precisely in the same position which it occupies in the ripe seed. All the evidence that I have thus been able to collect tends therefore to subvert Mr. Bennett's hypothesis. On the other hand, the explanation I have offered on a former occasion *, of the cause of a dorsal or lateral raphe occurring, as I believe it does, universally throughout the *Rhamnaceæ*, appears to me quite satisfactory: here, from a most simple and natural cause, originating either in the epipylar or allopylar pullulation of the nascent development from the basal placenta, we have the ovule either with a dorsal or lateral raphe; and, where dorsal, it is forced into that averse position by the mere act of the resupination of the ovule owing to the pressure of its growth against the base of the cell, in the manner first sagaciously suggested by Mr. Brown in the case of *Euonymus*. Had the same epipylar pullulation originated out of a higher point of the axis of the ovary, we should have seen in that case a pendent ovule with a ventral raphe, as occurs in the neighbouring family of the *Celastraceæ*, where in the same cell, from the cause here assigned, we sometimes meet with ovules, some with a ventral and others with a dorsal raphe.

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* Plant. Jav. rar. 131.

† Linn. Proceed. ii. 148–150; Ann. Nat. Hist. ser. 2. xi. p. 85.

‡ Theor. Syst. Plant. p. 178, and plate 15. fig. 5.

I will now advert to the other anomalous fact, in regard to the raphe, above alluded to. Botanists have always attributed to the seed of *Rhamnus* a chartaceous testa, with a raphe as a simple cord, that runs up its external face, or along one side, in a deep groove formed by a conduplicature of the whole seed, and then terminates in the apical chalaza; but one important circumstance connected with this structure has been altogether overlooked. I have found that this cord has a peripherical range similar to that in *Colletia*, with this difference, that instead of running laterally round it in the line of the margins of the cotyledons, it is directed along the middle of one cotyledon, in a deep groove upon the dorsal side, then crosses over the chalaza without any apparent interruption in its course, and returns down the ventral side in a direction close to the median line of the other cotyledon, till it again reaches the hilum.

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* Huj. op. p. 210; Ann. Nat. Hist. 3 ser. iv. 25.

As this structure is at variance with recorded descriptions, it is necessary to state the circumstances more in detail. My first observations were made upon the dried seeds of *Rhamnus catharticus*: this seed is smooth, of a hepatic brown colour, and of a flattish oval shape, somewhat tapering to the base, where it is callous and more polished; it is a little angular upon the ventral face, and rounded upon the dorsal side, along which is seen a line running from the apex to the base: on pressing it, this line is found to be the margin of a deep chink, which extends all the way down to the axis of the seed. If we carefully remove the outer coating, we find it rather thin, very brittle, and crustaceous, thus exposing a second tunic, which is very fine in texture, membranaceous, and polished, and upon its ventral side, opposite to the dorsal chink, is seen a distinct line running from the base to the apex, where it passes over a large areolar disk, and runs into the summit of the chink in continuity with the main cord of the raphe. If we take another seed, and cut it in two transversely, we see the outer brittle tunic just mentioned becoming somewhat thicker as it approaches the dorsal chink, where it is continued by induplication, in the form of two rather thick crustaceous plates that line the sides of the chink, the internal edges of these plates being quite disconnected with each other: it is evident, therefore, that this outer covering is not an entire tunic; for if it were unfolded, it would be found to be merely a thin plate with thick margins, which are introflected in the manner described. In the bottom of the chink, which widens towards the axis, is seen a thin membranaceous diaphragm, that forms one side of a square hollow cavity which runs through the axis from the apex to the base, and which diaphragm is found to be a portion of the second thin polished membranaceous tunic before mentioned, that lies beneath the outer crustaceous covering; and upon this diaphragm is observed the thick cord described by botanists as the dorsal raphe, which rises from the base, crosses the disk-like areole in the summit, and runs down the opposite side of the seed, forming the line first described as seen on the ventral face. The whole of this intermediate integument, with its entire raphe, may be exposed to view if we chip away in small fragments the outer crustaceous coating with the point of a knife, when the two cords, both ventral and dorsal, are distinctly seen; the two teguments are closely adpressed upon each other, except over the ventral cord, where there is always a considerable interval between them, thus showing that the raphe has no connexion whatever with the outer crustaceous coating. Beneath the second envelope is a third integument, which immediately invests the albumen, and which is thin and membranaceous; these two integuments, though free, are in immediate contiguity at all parts of their surface, except along the middle of the dorsal face, where they become separated to form the square hollow channel in the axis abovementioned, one side of which square, with the imbedded raphe, is formed by the induplicature of the intermediate integument. The embryo is broad and foliaceous, and is covered by a layer of fleshy albumen, equal in thickness to the cotyledons,—the margins of the whole, together with the enveloping tunics, being conduplicated into the hippocrepical form at first described. We see here, therefore, the existence of three seminal envelopes, very similar in their nature to those described in *Colletia,* with this remarkable difference, that in the latter the crustaceous coating is entire, while in *Rhamnus* it is always incomplete upon one side. In *Rhamnus catharticus* the groove formed by the conduplication of the seed is generally in the middle of the dorsal face, though sometimes nearly lateral, caused by unequal growth, in consequence of the partial abortion of one of the carpels; but in all these cases, the two lines of raphe always correspond with the middle of the cotyledons, while in the *Colletieæ* they constantly run along their margins*.

The same structure exists in *Rhamnus Alaternus*; but on account of the small size of its seeds, and the greater tenuity of the several integuments, it requires much care to dissect the parts. The crustaceous covering is very thin, and adheres more firmly to the extremely delicate intermediate integument, and it is therefore difficult to separate them without lacerating the latter; but when the separation is made with care, we find the ventral portion of the cord imbedded like a white line in that distinct integument, and running from the apex to the base: the dorsal groove is more shallow, and embraces the other corresponding portion of the raphe and integument, so that, on detaching the external crust, the raphe comes away with it, tearing itself from the rest of the integument†.

This structure is repeated, under somewhat varied circumstances, in *Rhamnus chlorophorus,* Dcne.: here, however, the raphe is lateral, not dorsal; the cotyledons are not involutely inflected, as in the former case, but are simply complicated or folded upon one another, so that their midribs stand opposite one margin of the seed, while all the four edges of the two cotyledons face the contrary margin, the albumen and integuments partaking of the same complicature. A deep groove is thus formed, reaching to the axis, as in *R. catharticus,* which here is therefore lateral, instead of dorsal; the raphe does not lie in the bottom of the deep groove, as in the latter species, but as it leaves the chalaza it runs along the mouth of the groove from top to bottom, as in *R. Alaternus,* and the middle integument, to which it is attached, here makes a deep plicature which nearly reaches the bottom of the groove; and throughout the whole length of this plicature it is separated on both sides, by a vacant interval, from the inner integument, thus forming a kind of loose, incomplete partition all down the groove. This intermediate tunic is membranaceous, and invests all other parts of the seed; it is enclosed within an external, hard, polished, testaceous covering, similar in texture and appearance to that in *R. catharticus,* but it is not, as in that species, inflected into the groove: the groove is here rather an open slit, always on the sinister margin (looking from the axis of the fruit), and is surrounded by a thick callous rim, which, rising from the basal and hilar point of attachment of the seed, extends upwards to one-third or half its length. This crustaceous coating lies close upon the intermediate integument of the seed over its two broad faces; but at its summit, and all along the other margin (opposite to that of the groove), a vacant space intervenes between them. The raphe is imbedded in that intermediate integument in the form of a simple cord, the thicker moiety of which runs along the base of the groove, and is free from it at all points, except at the bottom of the groove, where it adheres to it by means of a crustaceous deposit: it continues its course in a peripherical direction, crossing the apical chalaza beneath the free space mentioned, and runs down along the opposite margin of the seed, till it again reaches the pointed base or micropylar extremity of the inner integument. I have frequently succeeded in detaching the entire raphe with a portion of the integument in which it is imbedded (even from over the chalaza), when it thus appears in one unbroken peripherical band, containing spiral vessels: this separation of the raphe may be effected without disturbing the under or more internal integument, showing that it has no adhesion to it*.

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* Analytical details of this structure in *Rhamnus catharticus* are shown in Plate 33 A of this volume.

† This structure is also given in detail in Plate 33 C.

A very similar structure is found in *Rhamnus utilis,* Dcne.: here the embryo, the albumen, and the two integuments, are folded on one another exactly as in *R. chlorophorus,* the groove being, in like manner, constantly on the same sinister margin;

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* Complete details of this organization are given in Plate 33 B.

the testa also shows, on the dexter margin of the seed, a similar continuous cord of the raphe; but the intermediate integument, in its plicature within the groove, adheres on both sides to the inner tunic, till it arrives nearly at the bottom of the channel, where it suddenly separates from it, and crosses the groove in form of a diaphragm, leaving a vacant square space in the axis, formed by a separation of the integuments, which extends from the apex to the base, and upon this diaphragm is distinctly seen the main cord of the raphe,—an organization similar to to that of *R. catharticus*. The outer coating is of the same form as in *R. chlorophorus*, but of a different texture; it has the same longitudinal open slit along the lower half of the sinister margin, but its edges are more or less inflected into the groove. Its texture is not crustaceous, but consists of a thick simple membrane, invested with a number of compact long yellow cells, disposed horizontally, and aggregated into a lax spongiose covering, which sometimes partially adheres to the endocarp.

In *Frangula vulgaris* the structure is different from that of *Rhamnus*, even when the raphe is lateral, as I have shown it to be sometimes, in the latter genus. The seed is nearly orbicular and much flattened; the crustaceous covering is as thin and delicate as in *Zizyphus*, but its basal foramen is much larger, rounder, and more open, with two thick callous lips placed right and left of the axis, not anterior and posterior, as in that genus and in *Colletia*. Beneath it, and lying between it and the intermediate integument, there is a deposit like charred paper, which in most parts adheres to the external crust, but is separable from it, as in *Colletia*. On removing this, we find the very delicate intermediate membranaceous integument conical towards the base, where it terminates in a hooked thread, as in *Colletia*, and from which, right and left, along each margin, is seen a thick white cord, both arms being joined in one peripherical line over the apical chalaza. It will be remarked that, upon the sinister side looking from the axis, the cord is thicker and enveloped in a yellowish incrustation, which, for one-third the length of the seed, there adheres to the outer crustaceous coating, as was observed in *Rhamnus chlorophorus*. The embryo is perfectly flat; the cotyledons very thin and foliaceous, enclosed in an albumen of equal thickness; the two internal integuments are of extreme tenuity, and on that account are not easily separated. This organization, it will be seen, greatly resembles that of *Zizyphus**.

In *Zizyphus*, I find the course of the raphe also peripherical, but it runs along the lateral edges opposite the margins of the cotyledons, as in the *Colletieæ;* and we find here some points of structure deserving of being recorded. The outer corneous covering of the seed is entire, as in the *Colletieæ,* but much thinner in texture, and more translucent. This coating is of a more compressed form, tapering towards the base, which is polished and somewhat tumescent, and which has a basal chink similar to that of the *Colletieæ,* through which the nourishing vessels of the raphe pass from the placenta. It may here be observed, that in the bottom of each cell of the nut is seen a small fleshy cup, with a crenulate raised border, within which the seed is seated, and across the bottom of this cup is a white raised line, corresponding to the hollow in the basal chink of the seed; but the margins of this chink and the tumid base of the external coating are highly polished, and the latter shows no sign of any organic connexion with the cup: the hilar point of attachment is therefore confined to the mere cord of vessels proceeding from the placenta to the raphe. The second tunic, which is very thin and membranaceous, does not quite fill the cavity of the outer shell; it is more conical at its base, where it terminates in a short thread that issues through the chink above mentioned; the space between it and the outer shell is filled with a quantity of very lax white cellular tissue; it is pyriform in shape, much compressed, and tapers into a short cord at its base, which is seen to divide itself into two prominent threads that run along the margins of the tunic, and meet over a large fleshy chalaza-like disk in the apex, in one uninterrupted line: this cord of vessels is therefore completely peripherical, as in *Colletia.* This second tunic is quite free from a third, inner integument, which is thicker and more opake, and which invests a very thin fleshy albumen: this third integument is sensibly shorter, and more conical at its base, where it terminates in a dark areolar neck, and tapers into a short suspensor-like thread, which is embraced by the neck of the second tunic. These two integuments are easily separable from one another by the introduction of a needle between them, except round the margin of the apical chalazal disk, where they appear to be intimately agglutinated; the embryo is flat and compressed, its foliaceous cotyledons being parallel with the partition of the nut, and their margins contiguous to the peripherical cord of the raphe. This organization* is more evidently seen in this instance, as the seed is six times longer than that of *Colletia,* which it greatly resembles in structure: it is also remarkable for exhibiting many points analogous to the organization I have described in the seeds of *Cucurbitaceæ**.

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* This structure is fully shown in Plate 33 D.

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* Drawings of the above analysis will be given in Plate 33 E in this volume.

This singular extension and displacement of the raphe, accompanied by the formation of an extraneous crustaceous covering in the seed, is not altogether a novel fact, as I thought when I first remarked it in the *Cucurbitaceæ;* for the occurrence was partly noticed thirty years ago, in *Rhamnus,* by Brongniart, who, strangely enough, was not struck by the appearance of so remarkable a phænomenon, which he passed over without comment, and it has remained unnoticed by other botanists since that time. Brongniart's words are worthy of being quoted, as showing a notable correspondence with my observations. Alluding to the *Rhamnaceæ,* he says †: "Dans toutes ces plantes, le test lui-même, examiné au microscope sur des ovules déjà fécondés et à moitié de leur développement, est composé de trois couches très différentes; l'une, externe, n'est qu'un epidermis mince ‡; l'autre, moyenne, est solide et fibreuse, formée de fibres ou cellules alongées transversales, c'est elle qui doit former le test de la graine; enfin l'interne, très épaisse dans les premiers temps qui suivent la fécondation, est formée de parenchyme lâche, composé de cellules remplies de globules verts; elle s'atrophie, peu-à-peu, à mesure que l'amande et l'embryon se développent. C'est en général dans cette couche que passent les vaisseaux nourriciers, qui composent le raphé, et vont former la chalaze, raphé qui, dans ce cas, suit l'un des côtés de l'ovule en dedans du test, et *redescend en partie de l'autre côté,* après que la plupart des vaisseaux qui le composent, ont donnés naissance par leur épanouissement à la chalaze." The latter conclusion appears, however, to have been only conjectural §.

The entire peripherical circuit of the tracheal vessels in one of the integuments of the seed, which I have invariably found in one unbroken continuity, was therefore not fully traced by that eminent botanist, although it is evident, from the above quotation, that he had noticed the return of the raphe over the chalaza, and its partial descent down the contrary face of the seed. It is strange that this remarkable and novel feature was not afterwards alluded to, and that the mention of this extension of the tracheal vessels is omitted in the very copious diagnosis he gives of the order, where every other circumstance connected with the structure is carefully enumerated.

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* Linn. Trans. xxii. 92.

† Ann. Sc. Nat. x. 340.

‡ This is a thin layer of cellular tissue that invariably lines the epicarp, and partially adheres to the outer crustaceous coating of the seed in *Rhamnus,* and which I have not considered it necessary to mention in the preceding description.

§ "La chalaze vasculaire m'a toujours paru formée entièrement par une épanouissement des vraies trachées: elle est formée extérieurement par une expansion des vaisseaux du raphé" (*l. c.* p. 341).

Some indications, leading to a knowledge of the origin of the external crustaceous envelope of the seed in *Rhamnaceæ* may probably be drawn from Brongniart's valuable memoir above quoted, in which he records the changes which he observed during the periods of the impregnation and growth of the ovule in that family. These details were published in 1827, a year or two prior to the appearance of Mirbel's two celebrated memoirs on the development of the vegetable ovule, and before the modern nomenclature of the parts of the ovule and seed was adopted. I will therefore briefly recapitulate such of his observations as bear upon the subject under consideration. He noticed* that the stigmatic tissue terminated in a small cellular protuberance (since denominated the "telæ conductrices") in the inner angle of the cell of the ovary, close to the foramen of the anatropous ovule; and he remarked the condition under which the latter became fecundated: the ovule is always supported upon a somewhat elongated funicle filled with nourishing vessels, and surrounded by loose cellular tissue; this funicle, which is very contracted before impregnation, begins to swell from the moment that the stigma has received its fertilizing influence; it afterwards expands and extends itself over the foramen of the ovular tunic. Brongniart, who first traced the expansion of the boyaux of the pollen-grains, and their passage down the stigmatic channels†, was not then aware of their ultimate extension through the prominence he observed at the termination of those channels; nor did he notice the continuity of one of these boyaux with the minute thread which he had remarked in connexion with the embryo-sac, and which he considered to be an emanation from its neck: according to the notion he then entertained, he concluded that the act of impregnation was conveyed through the agency of the cellular tissue of the umbilical cord‡, which the fact he recorded of the swelling of the funicular support, and its subsequent extension over the coats of the ovule, seemed to support. I now call attention to this last-mentioned circumstance, because it may serve to explain some essential points of structure in the seeds of the *Rhamnaceæ*, and may enable us to trace the source of the external tunic of the seed, which, on account of its crustaceous or corneous texture, has been mistaken for the testa, but which is evidently of a different nature and origin.

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* Ann. Sc. Nat. x. 340.

† Ib. xii. 152 & 256; read before the Academy Dec. 26, 1826.

‡ Ann. Sc. Nat. x. 343: "Et c'est par l'intermédiaire de ce tissu cellulaire du cordon ombilical que je pense que s'opère l'impregnation de l'ovule,"—an opinion which he soon renounced after his subsequent important investigations into the growth of the ovule: Ann. Sc. Nat. xii. chap. p. 242.

I will also record some circumstances observed by me that may tend to throw an additional light upon the nature of this development. We very often find, in the fruits of *Rhamnaceæ,* that one of the carpels is sterile; here generally the abortive coccus grows nearly to its full size, but it is quite flattened, with its line of dehiscence, as usual, along the middle of the ventral face; in such carpels we always meet with a persistent unimpregnated ovule, standing upon its long funicle. In *Rhamnus chlorophorus,* for example, the sterile coccus is orbicular, and 1¼ line in diameter; the length of the ovule with its funicle is ⅝ line; it is erect; the foramen of the primine is distinctly open, and points downward, the tunic itself showing as yet no indication of any plicature; the secundine, seen through the primine, is shorter and smaller; and the nucleus is much narrowed, being scarcely half the length of the primine; while the chalaza is clearly visible in the summit, and also the thick distinct opake line of the raphe extending into it from the funicle. The position of the raphe, in this ovule, exactly corresponds with its place and direction in the ripe seed, showing, as I have before indicated (p. 235), that its situation, which has been considered abnormal in the seed, is not due to any twisting of the funicle, or to any disturbance caused by the subsequent plicature of the different parts of the ovule; and this we find to be further proved by the presence of the "telæ conductrices" immediately beneath the foramen of the primine, which would not happen had the ovule been forced round into this position by the torsion of its umbilical cord. I have found, in the several instances examined, the main line of the raphe and funicle constantly in one and the same position upon the dorsal face, everted more than the quarter of a circle (140°) from the point of zero, starting from the axial line of the fruit: from the chalazal summit, and down the contrary or ventral face of the primine, is seen a second cord, corresponding in position with the ventral raphe of the seed, and running from the summit to the mouth of the tunic. In one instance I traced the existence of spiral vessels for more than half the length of this cord; in another they were visible nearly as far as the foramen, but the dorsal cord was too opake to allow them to be detected, although their presence there cannot be doubted. The stipitate funicle was about a quarter of the length of the primine, and was covered with a number of elongated transparent cells, apparently in progress of extension, in the manner observed by Brongniart, as above quoted; and to their growth and expansion we may probably look for the origin of the crustaceous coating of the seed.

I have noticed precisely the same facts in *Rhamnus Alaternus*, where the raphe is strictly dorsal, as in *R. catharticus*; in one instance I observed that the coats of the ovule had become quite opake, the mouth of the primine being closed by a tumid expansion over it, and that this expansion embraced the long funicle, which had nearly disappeared: we may thus account for the total absence of any funicle in the ripe seed. I will not aver that this evidence is complete; but the disappearance of the funicle and the production of a distinct extraneous coating over the ovule, to whatever cause they may be owing, are most evident facts. There is much probability that this crustaceous coating derives its origin from the growth and expansion of the funicular support,—a growth first noticed by Brongniart, and apparently confirmed by what I have seen and recorded above. To this cause we may attribute the production of the vacant space that exists in the seed between the membranaceous integuments and the lower portion of the crustaceous coating, and also the appearance of the suspensor-like thread in which the base of the two membranaceous integuments terminates; for Brongniart recounts that, after impregnation, he found the mouth of the secundine embraced by the neck of the primine, just as I have described the appearance in the basal extremity of the two inner integuments of the seed of *Zizyphus*.

There exists in some instances yet another production over the seed, still more external than the crustaceous coating, the mention of which I have delayed till now. This expansion, which seems to proceed from the placentary point of attachment of the funicle, shows itself in a rudimentary state in *Zizyphus*, as I have before described it, under the form of a small free cup with a crenulated margin, which remains fixed to the pericarp, and in which the sessile seed reposes: this seems to be a constant feature in that genus. In *Phylica* and its congeners the seed is affixed in a stipitate cup that remains attached to it; this is fleshy, generally four-toothed on the margin, but in one genus is deeply cleft into ten radiating lobes.

In *Alphitonia* it assumes its fullest development, appearing as a thin, dark-coloured, brittle, submembranaceous, loose envelope, open at the top and sometimes also along the dorsal face; but in all cases the margins of this opening overlap each other, and thus entirely conceal the seed. This was first described by Fenzl*, who calls it "a brittle testa, covering the smooth cartilaginous endopleura." Endlicher†, on the other hand, designates it as an "arillus, covering a smooth corneous testa." Dr. Asa Gray‡, speaking of this tunic, "doubts if this membrane be a true arillus, as our materials are not sufficient for the complete investigation of its nature. Although marked with what seems like a raphe, it cannot be the testa or any proper integument of the seed, as Fenzl (in Pl. Hugel) took it to be, for it has no connexion with the corneous seed-coat at the chalaza, but only at the hilum; the chalazal end appears to be slightly open, as would be the case with an arillus: perhaps this membrane is a separable lining of the coccus."

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* Plant. Hugel, p. 20, sub *Colubrina excelsa*.

† Gen. Plant. no. 5712.

‡ Bot. Explor. Exped. Un. St. p. 278.

I have not been able to detect the presence of any kind of vessels in this tunic, particularly in the prominent line that "seems like a raphe," and which Endlicher positively calls a raphe: this prominence appears to me nothing more than a mere impression of the sutural line of the coccus, and is a common feature seen upon the corneous coating of the seed in the *Colletieæ* and other Rhamnaceous genera. The tunic certainly presents all the characters of an arillus; and, as Dr. Asa Gray justly remarks, it cannot be one of the proper integuments of the seed. The hard seed of *Alphitonia* is perfectly sessile within it, and is attached to it by a small open transverse fissure in its base, as in *Zizyphus*.

Other circumstances, however, present themselves in the organization which I have found in the seed of *Alphitonia excelsa*, that are worthy of record, as they completely confirm all the details of structure previously described, and which seem to prevail throughout the *Rhamnaceæ*. The second hard tunic, which lies within the outer brittle coating last described, becomes softened by maceration, when it is easily detached; it is then very lax, is of a pale-brown or yellowish colour, quite homogeneous in texture, void of any vessels, and encloses an oval body covered by a third tunic, which is notably smaller in size, and therefore leaves a considerable vacant space all round its sides and its summit, and is connected with the second tunic only at a small point in the base, which corresponds with the basal slit in the outer tunic of *Colletia* and *Zizyphus*. The summit of this third tunic is marked by a large tumid spot, evidently a chalaza, which exhibits no indication of any previous connexion with the second tunic; along each margin, emanating from the basal point of attachment, and crossing over the chalaza, there is seen a prominent white cord, filled with spiral vessels, which is imbedded in the fleshy tissue of the integument, in one continuous and completely peripherical line, exactly like that described in *Colletia* and *Zizyphus*. Within this tunic is yet a fourth, delicate integument, a thin albumen, and an embryo similar in form to that of *Colletia**.

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* The details of structure of the ovule and seed of *Alphitonia* are shown in Plate 33 F.

I have abstained from giving any denomination to the seed-coats in the foregoing descriptions; but we may now enter into this inquiry. In regard to the two inner coatings, no doubt can be raised against the obvious conclusion that the innermost is the tegmen produced from the secundine of the ovule, and that the other, in which the raphe is imbedded, is the true testa, developed from the primine, notwithstanding its soft fleshy texture. What, then, is the nature of the outer hard corneous coating in *Colletia*, the external crustaceous covering in *Rhamnus*, and the second tunic in *Alphitonia*? for there can be no doubt that they are all similar in their nature, and all derived from the same origin. The larger size of this tunic in *Alphitonia*, its lax condition in regard to the testa which it envelopes, the total absence of any cicatrix or mark that could indicate any previous connexion with the chalazal disk of the testa, are circumstances that manifest a distinct and subsequent origin. Indeed we have seen the proof of this in the seeds of *Rhamnus* (*ante*, p. 244), where in the same fruit we have found fertile and sterile carpels: in the latter case, the spiral vessels of the raphe were imbedded in the substance of the outer tunic of the ovule; in the former case, this raphe was found only in the second coating of the ripe seed: another adventitious coating, perfectly deficient of vessels, in the interval of growth had thus manifested its existence, apparently developed from the fleshy funicle which had simultaneously disappeared. This adventitious coating must therefore come within the category of an arillus. In such case the question presents itself—what is the nature of the outer brittle tunic in *Alphitonia*? Is it also an arillus, and have we in this genus two distinct arilli enveloping its seeds? The truth of this conclusion, at first sight, appears subject to little doubt.

On the other hand, I must not omit to record an instructive fact that I have observed in the fruit of *Alphitonia excelsa*. The fruit consists of three carpels, and, in the instance examined, only one of these contained a perfect seed; the two sterile carpels presented a single erect ovule, each being half the length of the carpel; the ovule was of an oval form, it had become thick and opake, its foramen was closed, and it was sessile within a short cup, with a lax undulating border, that was borne upon a solid stipitate support, of the same length and diameter as the body of the ovule. This was evidently an early stage of growth of one of the two arilliform coats of the seed, but whether of the inner or outer one, it is not easy to determine.

I have here suggested the probable assumption that the hard corneous seminal coating in *Colletia*, and the crustaceous covering in *Rhamnus*, derive their origin from a growth of the funicle

—an assumption strengthened by the original observations of Brongniart; but it might possibly be argued that this coating is developed from the primine of the ovule, simultaneously with the intermediate tunic in which we find the double raphe-like cord, in the same manner as has been contended, in the case of *Magnolia* (which I have endeavoured to show has been contested upon erroneous grounds), that these two tunics form a compound testa, both developed from one single ovular coating, the primine. Against this supposition, in the case of *Rhamnaceæ,* many serious objections present themselves, in addition to those I have elsewhere advanced* :—1. No trace of vessels of any kind is found in the outer coating. 2. There is no scar or other mark upon the apex of this outer coating, to indicate its previous attachment to the chalaza of the intermediate raphigerous tunic; on the contrary, there is always a considerable vacant space between that summit and the chalaza. 3. In many species of *Rhamnus,* this external crustaceous covering does not form an entire coating, but is open from top to bottom, as an enfolded flat plate would be: this could not possibly happen if it were a resilient portion of the growth of the primine. 4. In the ovule, we find a long funicle supporting it, which disappears altogether in the seed. 4. This disappearance of the funicle takes place very soon after the period of impregnation of the ovule, when it becomes lost within a thickening around the micropylar extremity of the primine, which is then enclosed by it, apparently as if this thickening, and the formation of the outer crust, proceeded from an expansion of the funicle. We may hence draw the almost certain conclusion that this external seminal tunic is of adventitious origin, and of a distinct growth, subsequent to the period of the fertilization of the ovule.

In regard to the yet more external brittle covering of the seed of *Alphitonia,* there appears no sufficient evidence to indicate the precise source of its origin with any degree of certainty; but the facts I have already recorded concerning the sterile carpels are of some value towards this end. It may be argued, as indeed it has already been suggested by Dr. Asa Gray (*ante,* p. 246), that this covering may belong to the pericarp, and not to the seed. This suggestion, however, may be regarded under two distinct points of view: the covering may be considered either as consisting of a resilient portion of the endocarp, or as a separate development formed within it, analogous to the ordinary arilliform productions around seeds. The former view conforms with the suggestion of Dr. Asa Gray, and coincides with the line of argument adopted by him in regard to the seed-coats of *Magnolia*, to which I have just alluded; and upon this supposition, the brittle covering of the seed of *Alphitonia* would consist of the endodermal lining of the endocarp, which becomes separated from it under the form of a resilient membrane. We have, however, strong evidence to prove that no such occurrence has taken place; for if it had, this tunic ought to exhibit on its ventral face the same sutural line of dehiscence that the endocarp does; on the contrary, we find the ventral face of that tunic perfectly entire, though marked by the impression of the hollow sutural line of the endocarp; and we notice an aperture in its apex, often continued some way down the dorsal face, and find that this opening does not form a sutural line, but that its margins are sinuous and overlap each other. It is therefore quite manifest that, if this tunic belong to the pericarp, it cannot be any resilient portion of the endocarp.

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* Linn. Trans. xxii. 86; Ann. Nat. Hist. 3 ser. i. p. 280; ibid. ii. p. 185; ibid. iii. p. 132, note, and pp. 144, 145, note.

Under the second mode of viewing this question, that it is a distinct formation, much evidence, in the way of analogy, may be drawn from other well-known cases; but I will refrain from entering into this consideration at present, as I shall on a future occasion discuss the nature of other adventitious coatings within the pericarp of seed-vessels, which seem to originate in peculiar depositions, or in the growth and expansion of the placental surface. Among the many kinds of development of this class, which seem to have attracted little notice, may be mentioned the pulpy sacs in which the seeds of *Cucurbitaceæ* are severally enveloped, each sac being attached to a distinct bundle of tracheal vessels branching from the broad placental laminæ, as described by St.-Hilaire*, where these pulpy sacs are at first solid and fleshy, and afterwards become liquid and mucilaginous. A very similar growth is developed from the placentary plates of the fruit of *Adansonia*, where a thick deposit is formed around each seed. *Leguminosæ*, too, offer numerous examples of analogous growth. The large ball of elastic silky hairs that envelope the seeds in *Bombax* and other kindred genera derives its growth wholly from the pericarp, and not from the seeds. In *Hydrophyllum* and *Ellisia* (Gærtn. pl. 110 & 184), the placenta grows round the seeds, which it soon encloses entirely, and fills the cell of the fruit. When the capsule bursts, this development looks like an internal coccus, assuming the appearance of a resilient endocarp, which opens into two valves corresponding with those of the capsule; and to the inner surface of these placentary valves the seeds are parietally affixed.

As regards the general structure of the flower in the *Colletieæ*, there is little to add beyond what we find recorded on the subject; but it may be remarked that the lobes of the calycine

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* Mem. Mus. v. 306.

border in that tribe, as in others of the *Rhamnaceæ*, have a prominent keel along the middle of their internal face, which terminates below the apex in an elevated callous gland, connected with two other raised lines that run along the border. These medial keels and glands have been supposed by some to be so many sterile stamens; but Brongniart, with more truth, considers their appearance to be the result of the impression left upon the soft fleshy lobes of the calyx, while in æstivation, by the indentation of the enclosed petals and stamens: that such is the real cause, is shown in the instance of *Gouania*, where a similar carinal prominence exists in the calycine lobes, and, in addition, at the base of each keel is seen an acute scale, which is really the rudiment of an abortive stamen. Similar impressions are frequent in many other families where the floral envelopes have a valvate æstivation. We meet with another point of structure in the *Colletieæ*, which, as far as I am aware, has not been noticed by botanists: I refer to the peculiar development of the stipules. Brongniart, who enters fully into detail respecting the several parts of the plant in the *Rhamnaceæ*, in describing their stipules, does not allude to it; he even states that these organs are entirely wanting in *Retanilla*, where I find this development to be a very characteristic feature. Beneath each spine and at the base of each petiole, a dark red-coloured broad scale is seen, which somewhat embraces the stem; it is concave, and terminates at the apex in two short teeth, or lengthened erect linear segments, the petiole appearing to spring from between them: in some instances, as in *Colletia, Talguenea, Trevoa, Adolphia,* and *Scypharia,* these stipular scales are simply amplexicaul; but in other cases, as in *Notophœna, Retanilla, Ochetophila,* and *Discaria,* those of the opposite axils unite in a short vaginal sheath, forming a dark transverse line around the stem, making each node seem to be articulated, as in *Ephedra*. Between each scale and its corresponding spine, a tubercular swelling originates, upon which both leaves and flowers appear, when, as frequently occurs, they are fasciculated: this tubercle is, in fact, a suppressed or undeveloped branchlet; the scales are the opposite stipules of the approximated decussating axils, some of which are sterile, while others produce both leaves and flowers, or each separately. This feature affords a very good discriminating character in some of the genera.

After these prefatory remarks, I proceed to the consideration, in succession, of the several genera of the *Colletieæ*, separating the tribe into three divisions :—1, where the petals are wanting, and the fruit is separable into distinct cocci; 2, where petals are present, with a similar fruit; 3, where petals are also present, but where the fruit is indehiscent.

Division 1. **Eucolletieæ.** Flores apetali; fructus capsularis, dehiscens.

1. Colletia.

A very good history of this genus is given by Sir W. Hooker in his 'Botanical Miscellany' (i. p. 150), but some confusion has existed among its species, which I have endeavoured to clear away. The species are mostly confined within the extratropical regions of South America, on both coasts; some few have been found within the tropics, one of them by Humboldt, at Huancabamba, in Upper Peru, at an elevation of more than 10,300 feet above the sea. The greater portion are met with near the base of the Andes, both on the western and eastern sides, at an elevation of from 2500 to 6000 feet, while others are seen only on the maritime sandhills along the coasts of Chile and in the low grounds bordering the river Plate. Commerson's plant, said by Jussieu to be from Brazil, is from the province of Buenos Ayres: one species is a native of the island of Juan Fernandez, in the Pacific. *Colletia* is readily distinguished from most others of the tribe by the absence of petals,—a character partaken of only by another, which I have proposed under the name of *Notophœna,* from which it is at once recognized by the peculiar form of its disk. In many genera of the tribe, the tube of the calyx is circumscissile in the line of its contraction above the basilar intumescence; *Colletia* differs from them in having its circumscissile zone midway between that line and the base, so that when the tube falls away, it carries with it its annular disk, and when seen from below, it seems closed by a diaphragm, pervious only for the passage of the style. When the fruit is half immersed in the persistent cupular base of the calyx, its epicarp forms a loose skin, which breaks round the margin of the cup, leaving its lower moiety persistent within it, while the upper moiety splits at the same time, to allow the separation of the three cocci (consisting of endocarp), which spring out of the calycine cup with elastic force, each coccus bursting by its axial line, as in *Euphorbiaceæ,* &c.; the remaining portion of the epicarp attached to the cocci comes off like a loose skin; but the mesocarp, which is membranaceous, adheres to the corneous endocarp.

Colletia, Comm.—Char. emend. *Calyx* cylindricus vel urceolato-tubulosus, imo tumescens et hinc demum circumscissus, 8–10-striatus, limbo 4–5-fido, laciniis acutis reflexis, intus carina prominula calloque apicali notatis, æstivatione valvatis. *Petala* nulla. *Stamina* 4 v. 5, inter lacinias calycis, rarius sub faucem, inserta; *filamenta* subulata, compressa, laciniis

fere æqualia vel breviora, erecta, apice sæpe inflexa; *antheræ* sub-2-lobæ, reniformes, oscillatoriæ, transversim 2-valves, valva antica quam postica breviore, et rima hippocrepica late hiante. *Discus* imo tenuissimus aut fere evanidus, ibique ad fundum calycis adnatus, margine (in coarctationem tubi) libero latissimo et convolutim inflexo hinc valde conspicuus, carnosus, et annularis. *Ovarium* superum, globosum, 3-sulcatum, 3-loculare; *ovula* in loculis solitaria, e basi erecta. *Stylus* filiformis, calyci æquilongus. *Stigma* parvum, obtuse 3-lobum. *Fructus* siccus, subglobosus, 3-sulcatus, calycis cupula semi-immersus, subcapsularis, in coccos 3 solubilis, coccis crustaceis, rima ventrali elastice 2-valvatim dehiscentibus, monospermis. *Semen* erectum, ovatum, vix compressum, ventre subangulatum; *tunica externa* nitida, durissima, cornea, *hilo* basali pervio et transversali; *integumentum secundum* membranaceum, et medio substantia laxe cellulosa subcoriacea opaca ad priorem agglutinatum, raphigerum; *raphe* filiformis, e basi lateraliter orta, hinc cursu omnino peripherico apicem transiens, et tunc altero latere ad hilum iterum regrediens; *integumentum internum* præcedenti laxatum, membranaceum, subopacum, a medio sensim arctatum, et imo in cerviculam filiformem brevem terminatum, *chalaza* majuscula carnosa apicali munitum. *Embryo* intra *albumen* carnosum inclusus; *radicula* brevissima, infera, tereti, *cotyledonibus* carnosis foliaceis, planis, cordato-ovatis.

Suffrutices *Americæ Meridionalis, plerumque extratropicales, intricato-ramosi, subaphylli,* ramis *decussatim oppositis, divaricatis,* ramulis *spinescentibus,* spinis *subulatis sæpe compressis, interdum latissime expansis et decurrentibus;* folia *paucissima, minuta, sæpe rudimentaria, opposita, integra;* flores *infra spinas orti, albidi vel albido-rosei,* pedicellis *1-floris, nutantibus.*

1. *Colletia spinosa,* Lam. Illustr. ii. 90. tab. 129; Dict. Suppl. ii. 312; DC. Prodr. ii. 28.—C. horrida, *Willd.* i. 1113; *Vent. Hort. Cels.* 92.—C. polyacantha, *Willd. in R. & Sch.* v. 113.—Rhamnus Yaquil, *Domb. MSS.*;—spinosissima, ramulis spinisque compressis valde striatis, striis in ramulis spiraliter, in spinis recte parallelis, spinis validis, longiusculis, decussatis, subulatis, apice callo acutissimo rubro terminatis; foliis parvis, oblongo-ovatis, glaberrimis, integris, aut summum versus denticulatis, caducissimis, breviter petiolatis, infra spinas insertis; floribus solitariis, vel paucis fasciculatis e tuberculo sub spina ortis, pedunculis brevibus reflexis; calyce cylindrico, medio constricto, imo ampliore et subgloboso, limbi laciniis 5, reflexis, acutis, apice callo instructis, staminibus parvulis ore

fere sessilibus, filamentis brevissimis deflexis.—Buenos Ayres: —*v. s. in herb. Jussieu, in Mus. Paris* (Commerson).

This species must be considered as the type of the genus which, according to Jussieu (Gen. Plant. p. 380, ann. 1789), was first proposed by Commerson for a plant of his collection, who, however, assigned to it no specific designation: its first name, *Colletia spinosa*, was given by Lamarck (in 1793), in his 'Illust. Gen.' tab. 129. Willdenow (in 1798) published the same plant, the only species then known, under the name of *Colletia horrida*. Poiret (in 1811) first detailed the characters of the genus, and Ventenat, in the meantime, figured and described two other plants, which he referred to *Colletia*. Poiret states (Encycl. Meth. Suppl. ii. 312) that Lamarck figured his type from the plant brought from Peru by Jos. de Jussieu, and from Brazil (Buenos Ayres) by Commerson; but he evidently confounded two species together. I have seen the original specimens of these two plants, which are preserved in the Jussieuan Herbarium, and fastened on the same sheet. Commerson's specimen above described appears to be that figured by Lamarck as *Colletia spinosa*; Jussieu's plant, of which there are two small specimens, one in flower, the other in seed, corresponds with another larger specimen collected also in Peru (Tarma) by Dombey, which I have described under the name of *C. aciculata*. Lamarck's figure, though coarsely drawn, is tolerably correct; but the spines in the specimen are longer than are there represented, and not at all curved. I have adopted from his description and plate the character of the leaves which are now wanting in the two existing specimens, both collected by Commerson in "Buenos Ayres," or at least in the Argentine Provinces. In the full-grown specimen, the spines are an inch long, and a line in diameter at the base; in the younger specimen, with the flowers in bud, the spines are somewhat shorter, more slender, and more terete; they are all of a dark green colour when dried. The leaves in Lamarck's figure are 4 lines long and 2 lines broad. The slender reflexed peduncles are about a line long; the tube of the calyx is 2–2½ lines long, 1½ line in diameter, its segments being 1 line long and ½ line broad*.

2. *Colletia intricata*, n. sp.;—spinosissima, glaberrima, ramulis compressis, spinis longis, curvulis, spinulisque decussatis, teretibus, subulatis, apice callo acuto rubro pungentibus; foliis rarissimis, oppositis, oblongis, crassiusculis, obtusis, dentatis, 3-nerviis, imo in petiolum sublongum canaliculatum gradatim

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* A figure of this species, with analytical details, is given in Plate 34 A of this volume.

angustatis, e sinu dentium stipulæ minutæ enatis; floribus pro genere majusculis 2–3, fasciculatis, e tuberculo squamoso infra spinas prodeuntibus, nutantibus; calyce cylindrico, tubo amplo, 10-nervio, rubescente, imo carnoso, limbi laciniis 5 albis, reflexis; staminibus in sinubus subsessilibus, filamentis brevissimis.—In Andibus Mendocinis et Chilensibus:—circa Uspallatam (altit. 6000 ped.) et procul Mendoza (2600 ped.) mihi lecta;—*v. s. in herb. Hook.* in Andibus Mendozæ (Gillies);—Chile (Bridges), a Valparaiso missa, sed forsan in Andibus lecta. Vernac. *Yaquil.*

This differs from the typical species in its longer, more slender, and more terete, obsoletely striated spines, in its general glaucous hue, in the form of its leaves, which are denticulated, and especially in its conspicuous and larger flowers. It forms a low, branching, spiny, and almost leafless shrub. Its decussating nodes are half an inch apart; its spines are opposite, from 7 to 15 lines long; the leaves are 3 lines long, 1½ line broad, upon a petiole of 1 line in length; the petiole is inserted in a sharp notch on the apex of a minute rigid stipular scale beneath each spine, and between the stipule and spine is seen the squamose tuft out of which the flowers spring. The flowers are of a deep rose-colour, with a white reflexed border, and are larger than the other species of the genus; the pedicel is 2 lines long; the calyx is tubular, not contracted in the middle, fleshy at the base, 3 lines long and 2 lines in diameter, the segments of the border being in addition 1 line long and ¾ line broad*.

3. *Colletia invicta*, n. sp.;—spinosissima, ramulis spinisque compressis, glauco-pruinosis, subflavis, et molliter puberulis, spinis 3-seriatim spinulosis, crebris, validis, intricatis, apice callo rubro pungentibus; foliis in ramulis novellis parvulis, ovatis, utrinque acutis, crassiusculis, enerviis, margine crenulatis, ubique puberulis, subreflexis, subimplicatis, fere epetiolatis, caducissimis, e stipula enatis; floribus majusculis, roseis, 4–6 e tuberculo squamoso infra spinas fasciculatis, nutantibus; calyce cylindrico, tubo amplo, 10-nervio, rubro, imo carnoso, disco basin versus annulari, limbi laciniis 5, carnosulis, pallidis, reflexis; staminibus in sinubus parvis, filamentis brevissimis, stylo exserto.—Chile?—*v. s. in Herb. Mus. Paris* (*sine designatione*).

This is very different in habit from the former, being of a deep yellow hue, somewhat pubescent, with much shorter and thicker spines and closer axils. The primary spines are 1½–2

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* This species will be shown in Plate 34 B of this volume.

inches long, the secondary spines $\frac{1}{2}$–$\frac{3}{4}$ inch long, and 4 lines apart, and the tertiary spinelets are 3 to 4 lines long, all forming a dense entanglement; the leaves are channeled above, about 2 lines long, 1 line broad, tapering into an almost obsolete sulcated petiole; the pedicels are 2 lines long; the tube of the calyx is 3 lines, and its segments 1 line long; it is quite cylindrical, and 2 lines in diameter; the filaments are only $\frac{1}{4}$ line in length, the anthers globose. The flowers much resemble those of the preceding species in size and form, but the annular disk is placed nearer the base of the tube; they are quite glabrous.

4. *Colletia ferox,* Gill. & Hook. Bot. Misc. i. 154. tab. 44 B;—implexo-spinosa, ramulis abbreviatis, aphyllis, viridibus, spinisque oppositis, subulatis, compressis, iterumque decussatim spinosulis, substriatulis, pungentibus, hinc confertim intricatis; floribus rosaceis 2–3, fasciculatis, sub spinis e tuberculo squamoso ortis; pedunculo flore paulo breviore, calyce medio constricto, imo subgloboso, limbi laciniis 5, reflexis, staminibus 5 parvulis in fauce inter lacinias fere sessilibus; stylo exserto; fructu 3-lobo, subgloboso, cupula calycina suffulto.—In Andibus Chilensibus et Mendocinis.—*v. s. in herb. Hook.* (Gillies, Cuming).

This species is very different in its general appearance from the three preceding, its spines being much shorter, very much entangled, and of a dark colour; its flowers are smaller, and more contracted in the middle. The primary spines are 2–2$\frac{1}{2}$ inches, the secondary $\frac{1}{2}$ to 1 inch long; the tertiary spinelets are 2 to 4 lines; they are all quite glabrous. The pedicels are very slender, 2 lines long; the calyx, including the segments of its border, is 3 lines long and 1$\frac{1}{2}$ line in diameter at the mouth; the flowers are of a pale reddish-white colour, and of thin texture*.

5. *Colletia atrox,* n. sp.—Discaria Americana, *Hook. in partem, Bot. Misc.* iii. 172;—horride spinosa, ramulis pallide olivaceis, striatulis, spinis elongatis, validissimis, crassis, secundariisque brevibus decussatim oppositis, glaberrimis, valde compressis, imo latis et hinc subdecurrentibus, pallide viridibus, apice calloso-pungentibus, aphyllis aut foliis caducissimis; floribus majusculis, palidissimis, 2–8, fasciculatis, e tuberculo squamoso ad basin spinarum enatis; pedunculo flore paulo breviore, calyce late tubuloso, medio subconstricto, textura tenui, albido, imo inflato, limbi laciniis 5 revolutis; antheris parvulis, globosis, in

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* A representation of this species is given in Plate 34 c.

ore fere sessilibus, stylo exserto, imo articulato, et mox caduco, ovario globoso, 3-lobo.—Buenos Ayres.—*v. s. in herb. Hook.* (Tweedie).

The strong and flattened spines of this plant give it a peculiar character, which indicates an approach to the following remarkable species. The branchlets are about 4 inches in length, the primary spines 1½ inch long, gradually diminishing upwards; their secondary spines, in one, two, or three almost horizontally salient decussating pairs, are from 3 to 6 lines long, much flattened and spreading at their base, where they are 2 lines broad and half a line thick, all armed with a reddish, sharp, callous point; they are of a greenish pallid hue. The flowers, in clustered fascicles, are nearly the size of those of *C. intricata,* and of the same pale colour; the tube is more globose at the base, and much contracted in the middle, 2½ lines long, the diameter of its mouth 1½ line, and the reflected segments 1 line in length: the slender peduncles are 2 lines long. This plant, by mistake, is confounded with *Discaria Americana* in the 'Botanical Miscellany'*.

6. *Colletia cruciata,* Gill. & Hook. Bot. Misc. i. 52. tab. 43; ibid. iii. 172.—C. Bictonensis, *Lindl. Journ. Hort. Soc.* v. 29 cum icone.—Condalia paradoxa, *Spr. Syst.* i. 825;—suffruticosa, 3–4-pedalis, ramosa, ramulis subangulatis, spinis magnis, horridis, decussatim oppositis, valde compressis, latissime expansis, longe decurrentibus, et apice calloso-pungentibus ubique tectis; junioribus pilis incanis adpressis hirsutulis sparsim tomentellis, foliiferis; foliis perpaucis, cito caducis, ellipticis, dentatis, apice acutis et mucronatis, basi in petiolum brevem canaliculatum attenuatis, sub spinis e stipula 2-dentata enatis; floribus parvis 6–8, fasciculatis, e tuberculo squamoso tomentoso ad basin spinarum ortis, pedunculo flore breviore, calyce cylindrico, albo, basi viridi, medio non constricto, obscure 10-nervio, limbi laciniis 5 patentibus, staminibus 5 parvis fere sessilibus inter lacinias sitis, stigmate obsolete 3-lobo, incluso.—Banda Oriental.—*v. s. in herb. Hook.*—Maldonado (Gillies).

This plant was raised in England many years since, and then erroneously supposed to be a hybrid, or a monstrosity of *C. spinosa,* and was described by Dr. Lindley under the name of *C. Bictonensis.* It is the most remarkable species of the genus, on account of its monstrous spines, which are flattened, and extend from one axil to another in cruciating and divaricating pairs: they are nearly an inch long and 3 to 6 lines broad at

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* A drawing of this plant is given in Plate 34 D.

their base. Its leaves are very caducous, oblong, acute, with a mucronate apex, more obtuse at the base, fleshy, obsoletely 3-nerved, toothed on the margin, quite glabrous, 2 lines long, 1 line broad, on a slender petiole of 1 line in length; this springs out of a sinus of a bidentate acute stipule, also caducous. The flowers are smaller than in any of the preceding species, and are of a whitish colour: the length of the tube is 1½ line, of its reflected segments 1 line, its diameter 1 line. The annular perigynous disk is green, and situated near the base of the tube; the filaments are one-fourth of the length of the segments, and are reflected within the mouth; the style is exserted. The capsule is 2½ lines in diameter, 3-lobed, and seated in the free cupular persistent base of the calyx*.

7. *Colletia Weddelliana*, n. sp.;—intricato-spinosa, ramulis nodos versus compressis, ochraceo- vel glauco-pruinosis et granulato-punctatis, spinis teretibus, imo compressis, substriatis, iterumque spinulosis, apice glanduloso-pungentibus; foliis parvis, caducissimis, lanceolato-oblongis, utrinque acutis, integris vel summo dentatis, pallide glaucis, crassis, enerviis, convexis, rachi superne sulcata, inferne prominula, petiolo brevissimo, canaliculato, deflexo; floribus paucis, fasciculatis, e tuberculo squamoso majusculo puberulo proficiscentibus; calyce cylindrico, 10-nervi, rubello, medio non constricto, imo carnosulo, limbi laciniis 5 reflexis, 3-nerviis, apice callosis, staminibus 5 in sinubus fere sessilibus, disco annulari crenulato, stylo incluso.—Bolivia, in locis aridis petrosis, Puna ad Lac. Titicaca, altit. 12,000 ped.—*v. s. in herb. Mus. Paris* (Weddell, 4391).

This species much resembles *C. atrox* in general aspect, but its spines are not so broad and compressed at their base, and are of a more glaucous-yellow hue; the form of the calyx corresponds more with that of *C. spinosa* in being broad and little constricted. The spines vary in length from 6 to 9 lines, are greatly divaricated or nearly patent, and are decussating, the internodes being 4 to 6 lines apart. The leaves are 3 lines long, 1¼ line broad, thick, coriaceous, convex and channelled above, concave below, with revolute toothed margins; each pedicel is 1 line long; the length of the calyx (including its reflected segments, of nearly 1 line) is 3½ lines, and its diameter 1½ line†.

8. *Colletia Kunthiana*. C. spinosa, *H. B. K. Gen. Sp.* vii. 59 (non Lam.).—Fruticosa, 1–2-orgyalis, ramosissima, et intricato-spinosa, ramulis obsolete striatis, fusco-brunneis, adpresse hirtellis, ad nodos compressis, spinis subbrevibus,

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* This species is represented in Plate 34 E of this work.

† A drawing of this plant is given in Plate 34 F.

validis, subcurvulis, acumine calloso-pungentibus, junioribus foliiferis; foliis subsessilibus, parvulis, spathulato-lanceolatis vel obovatis, obtusis, integerrimis, concavis, infra carinatis, caducissimis, petiolo brevissimo, imo stipulis 2 ovatis minutis coadunatis instructo; floribus 1–4, fasciculatis, e tuberculo squamoso prodeuntibus; pedunculo flore pendulo breviore, calycis tubo rubescente tenuiter membranaceo, 10-nervio, basi tumido, limbi laciniis 5 acutis, reflexis, staminibus in sinubus fere sessilibus, stylo tereti, stigmate capitato-3-lobo, paulo exserto; capsula sub-3-loba, 3-cocca, cupula calycina, grandefacta, immersa, pisi magnitudine.—Huancabamba Altæ Peruviæ, altit. 10,300 ped.—Vernac. *Zarza de Moyse.—v. s in herb. Mus. Paris* (Bonpland) a cel. Kunthio missa.

This species has a fuscous hue, with short interlaced spinelets: the primary spines are 2 inches long; the secondary 8–10 lines, and 5 lines apart; the tertiary spinelets are 3 lines long, very stout, with a sharp point. The leaves are very caducous, and are wanting in the specimen I have seen, but they are described by Kunth. The flowers are small, of a reddish hue, many of them appear sterile, and soon fall off; the segments of the border are nearly as long as the tube, each being about 1 line long; and the tube is cylindrical, 1 line in diameter; the disk is seated near its base: the pedicel is only $\frac{3}{4}$ line long in the flower, and 2 lines in fruit. The 3-lobed capsule, supported on the cupular remnant of the calyx, is $2\frac{1}{2}$ lines in diameter*.

9. *Colletia tenuicula*, n. sp.;—fruticosa, ramis teretibus, striatis, pallide olivaceis, pubescentibus, ramulis tenuibus, divergentibus, spinosis, spinis decussatim oppositis, acicularibus, simplicibus, nonnullis inferioribus iterum 2-spinulosis; foliis parvulis e ramulo novello inermi infra spinam enato, et ea dimidio breviore, crebriter approximatis et quasi fasciculatis; floribus 2–4 fasciculatis, infra spinas protensis, parvulis, pedicellisque gracilibus, glabris, erectis; calycis tubo rubescente infundibuliformi, tenuiter cylindraceo, imo globosim inflato, ore ampliore, limbi laciniis 5 acutis, revolutis; staminibus inter lacinias fere sessilibus, antheris parvis, globosis; ovario subgloboso, 3-sulcato, stylo filiformi, paulo exserto.—Patria ignota (forsan Buenos Ayres).—*v. s. in. herb. Mus. Soc. Linn. ex herb. Linn. fil. cum indicio* "Cavanilles 1803."

This is a delicate and slender species. The specimen above quoted is a mere fragment, 6 or 8 inches in length, originally contributed by Cavanilles to the younger Linnæus, whose herbarium passed into that of Sir Jas. Smith (now the property of the

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* This species is shown in Plate 35 A of this volume.

Linnæan Society). In habit it greatly resembles some of the species of *Discaria,* for which, at first sight, it might be mistaken. Its primary spines are very slender, almost acicular, of a pale green colour, pubescent, and about 2 inches long; the secondary spines, still more slender, are from 4 to 9 lines in length; the tertiary spinelets are only a line long: its filiform peduncles are 1½ line long, the very slender tube of the calyx, including the segments, is 2 lines long, the tube being ⅓ line in diameter*.

10. *Colletia pungens,* n. sp. C. spinosa, *Hook. in partem, Bot. Misc.* i. 154. tab. 44 A (*non Lam.*); *ibid.* iii. 173;—ramis ramulisque glaberrimis, pallide glaucis, aphyllis, aut foliis caducissimis, ad nodos compressis, horride spinosis, spinis longis, validis, divaricatis, decussatim oppositis, subulatis, striatis, apice callo rubro pungentibus: floribus parvis, binis, vel pluribus fasciculatis, e tuberculo squamoso tomentoso infra spinam vel interdum e medio spinarum ortis, pedunculo glaberrimo flore breviore, calycis tubo longiuscule cylindraceo, imo globose ampliato, limbi laciniis 4–5, acutis, reflexis, staminibus totidem sinubus insertis, filamentis longiusculis, exsertis, erectis, laciniis paulo brevioribus, antheris parvis, viridibus, stylo longe exserto.—In Andibus Chilensibus.—*v. s. in herb. Hook.* La Guardia (Gillies); Mendosam versus (Gillies): Chile (Meyen): *in herb. Mus. Paris* (Gay, 2).

The general habit and appearance of this plant are like those of *C. spinosa,* Lam., but its flowers are much smaller, its stamens much longer, and ostensibly exserted: its armature is stouter, the primary spines are about 2 inches long, the secondary ones 6 to 9 lines long, diminishing upwards, and 4 to 5 lines apart; the flowers are numerous, frequently as many as eight from each spine: the pedicels are slender, 2 lines long; the length of the tube is 1¾ line, and of the segments 1 line, its diameter half a line; the filaments are erect, half the length of the segments; the style is exserted, and is deeply bullated or torulose all over its surface†.

11. *Colletia Spartioides,* Bert. Ann. Sc. Nat. xxi. 347; Hook. Bot. Misc. iii. 173; Colla, Mem. Torin. 37. p. 52. tab. 6;—sub-2-orgyalis, ramosissima, ramis virgatis, ramulis gracilibus, flexuosis, spinosis, junioribus sicco viridibus, pubescentibus, adultis glaberrimis, pallide glaucis, spinis subsparsis, decussatim oppositis, curvulis, compressis, longissimis, gracillimis, striatis, intricatis, apice pungentibus; foliis oppositis, spathulato-oblongis, basi attenuatis, margine serrulatis, obsolete

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* A representation of this species may be seen in this work, Plate 35 B.

† A figure of this species is given in Plate 35 C.

3-nerviis, glabris, petiolatis, e retinacula stipulari infraspinali breviter divaricata fusco-rubra 2-dentata ortis; floribus paucis, glomeratis, sub spinis enatis, pedunculo flore breviore, calyce breviter cylindraceo, imo globosim inflato, limbi laciniis 5 acutis, revolutis, staminibus erectis, laciniis dimidio brevioribus.—Insula Juan Fernandez.—*v. s. in herb. meo et in herb. Mus. Paris* (Guillemin, Bertero); in *hb. Hook.* (Bertero, 1448; Cuming).

This species is remarkable for its broom-like habit and the branchlike length of its extremely slender and lax spines. Bertero describes it as a tree 8 or 10 feet in height, with whitish flowers of a rose-coloured tint, and as being almost bare of leaves: its leaves, however, are larger than in any other species, measuring 9 lines in length (including a petiole of 1 line) and 2½ lines broad. The pedicels are 1½ line long, the tube of the calyx 2 lines, the segments 1 line long, and the tube is 1½ line in diameter; the position of the disk is marked by a line of constriction above the semiglobose base of the calyx. The fruit, surmounted by the persistent style, is nearly globose, 2 lines in diameter, and supported by the lax persistent cup of the calyx*.

12. *Colletia cataphracta*, n. sp.;—intricatissime spinosa, fulvotomentella, aut parce pilosula, ramis elongatis, strictis, ramulis teretibus, ad nodos subcompressis, erectiusculis, spinis crebriter decussatis, nonnullis iterumque spinulosis, breviusculis, sulcato-striatis, pallidiusculis, apice calloso-pungentibus; foliis minusculis, ovatis, utrinque acutis, apice mucronatis, enerviis, glaberrimis, caducissimis, petiolo canaliculato, subreflexo, sub spina in sinu stipulæ minimæ rigidæ apice 2-dentatæ inserto: floribus plurimis, parvulis, fasciculatis, e tuberculo squamoso stipula suffulto enatis, pedunculo subbrevi, calycis tubo medio angustato, subinfundibuliformi, imo globosim inflato, limbi laciniis 5 revolutis, staminibus 5, laciniis æquilongis, erectis, stylo antheras parvas globosas attingente.—Chile meridionalis; *in herb. meo* (Miller).

The above plant was given to me by Dr. Miller, who I believe obtained it in the south of Chile, from the neighbourhood of Concepcion. Its main branch is perfectly straight, a foot in length from where it has been cut off, having evidently been longer; it is 1½ line in thickness: the primary nodes are 1½ inch distant, the secondary and tertiary 3 lines apart; the primary spines or branchlets are 1 to 2½ inches long, gradually decreasing upwards; the secondary spines are 9 lines, the tertiary 3 or 4 lines long, all terminated by a reddish corneous sharp point;

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* This species is shown in Plate 35 D of this volume.

the leaves, including the petiole, measure only a line in length, and ⅓ line in breadth; the flowers are small, and of a pale whitish colour; the peduncle is ½ line long, the tube of the calyx 1¼ line in length, the segments ¼ line long, the tube barely ½ line in diameter*.

13. *Colletia armata*, n. sp.;—intricato-ramosa, ramulis subcompressis, sicco fusco-olivaceis, parce pubescentibus, spinosissimis, spinis elongatis, subpatentibus, striatis, iterumque longiuscule spinulosis, apice acute pungentibus: foliis utrinque glabris, ovatis, imo obtusis, aut vix acutis, remote dentatis, fortiter 3-nerviis, nervis supra sulcatis, petiolo brevi canaliculato reflexo, stipula rigida 2-dentata suffulto; floribus 2–5, e tuberculo stipula sustentato infra singulam spinam ortis, vel e medio spinæ nascentibus: pedunculo flore paulo breviore, calycis tubo late cylindrico, limbi laciniis 4–5, oblongis, acutis, reflexis, staminibus totidem, erectis, laciniis dimidio brevioribus, stylo vix exserto.—Chile.—*v. s. in herb. meo* (Bridges, 140); *in herb. Mus. Paris,* Valdivia (Gay, 49); Chile (Gay); Valparaiso (Gaudichaud, 1268); Monte La Leone (Bertero); Valdivia, Rio Callecalle (Lechler, 391).

This species is recognized by the unusual length and distance of its spines, which are somewhat curved, and not stout. The branchlets, in my specimen, are about 7 inches long, and barely a line in diameter: the primary spines are from 1 to 2 inches long, and about ¾ inch apart; the secondary spines are from 7 to 10 lines long: the oblong leaves, with a toothed margin, are 3 to 5 lines long, 1½ to 2½ lines broad, decurrent on a deeply channelled deflected petiole 1 line long; the nervures are sulcated on the upper surface, and prominent beneath: the flowers are small and pale, clustered together upon a large scaly tubercle; the pedicels are 1 line long, the tube, contracted for some length in the middle, is 2 lines, and its segments ¾ line long; it is ¾ line in diameter: the peduncle in fruit is thicker, 2 lines long, and the 3-lobed capsule is 2½ lines in diameter. In Bridges's and one of Bertero's specimens, the spines are much stouter and longer, much paler, yellowish, being 1½ to 2¼ inches long, and a line or more in thickness, and they bear no spinelets, but two pairs of floriferous nodes upon each†.

Var. *β. insularis*: spinosissima, spinis iterumque spinosis, validiusculis, striatis, foliis caducissimis; floribus 2–4 fasciculatis. —Insula Chiloë.—*v. s. in herb. meo et Hook.* (Capt. King).

This variety is very dissimilar in appearance to the foregoing, but has no tangible differential characters; it is of a darker olivaceous hue, and quite glabrous; the primary spines are 8 lines apart and 1½ to 2 inches long, the secondary spines 3 lines apart and 6 to 9 lines long; the pedicels 1½ line long, and the flowers are like those of the preceding.

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* This is illustrated in Plate 35 E.

† A figure of this species is given in Plate 35 F.

14. *Colletia dumosa*, n. sp.;—suffruticosa, humilis, ramosissima, intricato-spinosa, fusco-viridis, ramulis tortuosis, teretibus, creberrime spinosis, parce pilosulis, spinis interdum ternatim verticillatis, iterumque spinulosis, spinulis oppositis, brevibus, teretibus, crassis, substriatis, imo et medio floriferis, apice callo glauco nitente pungentibus; foliis caducissimis, aut nullis; floribus albis 2–5, fasciculatis, glaberrimis, spinulis longioribus, e tuberculo squamoso ortis, fragrantibus, calyce pedunculo subæquilongo, imo tumido et 5-sulcato, medio constricto, limbi laciniis 5 acutis, reflexis, staminibus 5 laciniis fere æquilongis, erectis, antheris parvis, viridibus, stylo exserto, fructu 3-cocco.—Chile.—*v. v.* ad Concon, in dumetis arenosis maritimis frequens: vern. Junco.—*v. s. in herb. Mus. Paris*: Chile (Gay, sub *C. ferox*): Chile (Gay, sub *C. spinosa*): Chile boreali (Pöppig); in arenis humidis, Talcahuano (Lechler, 2794).

The drawing and floral analysis I made of this plant thirty-five years ago are still preserved, but my specimens were lost by shipwreck. I have still many of its seeds, which enabled me to investigate the seminal structure given in a preceding page. The species is closely allied to *C. armata*, but differs in its much closer axils and much shorter spines; the floral pedicels are more elongated, and the stamens are longer and more exserted. The primary spines or branchlets are 2–3 inches long, the secondary spines are 8–10 lines long and 3 lines apart, the tertiary spinelets are 4–5 lines in length and 2 lines apart; the secondary spines, often opposite, are frequently ternate; the pedicels are 2 lines long; the tube of the calyx, which is cylindrical and somewhat swollen at the base, is 2¼ lines, and the segments 1½ line long and ¾ line diameter; the filaments are erect, and ¾ line long*.

15. *Colletia veprecula*, n. sp. C. spinosa, var. pubescenti-incana, *Hook. Bot. Misc.* i. 154;—suffruticosa, intricato-ramosissima, ramulis strictis, teretibus, pulverulentis, spinis oppositis, interdum ternis, crebre decussatim spinulosis, puberulis, spinulis brevibus, approximatis, striatulis, apice callo rubro nitente pungentibus; foliis parvulis, late obovatis, apice rotundis,

* A drawing of this species, with analytical details of the structure of the seed, is given in Plate 36 A.

emarginatis, et mucronulatis, utrinque pubescentibus, serrato-dentatis, a medio basin versus integris, et hinc in petiolum brevem canaliculatum cuneatis, in ramulis novellis præstantibus, cito caducis; floribus 4–6 fasciculatis, parvulis, e tuberculo albido-tomentoso ortis; calyce pedunculo æquilongo, tubo cylindraceo, imo inflato, medio constricto, limbi laciniis 5 longiusculis, acutis, reflexis, staminibus laciniis dimidio brevioribus, erectis, stylo exserto stamina attingente.—Chile. —*v. s. in herb. meo*; Valdivia (Bridges, 141); Valparaiso (Cuming, 705);—*in herb. Hook.*; Concepcion (Beechey).

This is a very distinct species, with stout and very straight branchlets, 8 to 18 inches long, or perhaps longer, quite terete, pruinose, or sparsely tomentose; the primary spines, frequently ternate and very spreading, are scarcely longer than the internodes, which, together with their very divaricate spinelets, give to the branches an interrupted spicate appearance. The ramal internodes are $\frac{3}{4}$ inch apart, the primary spines are 1 inch long, the secondary spines are $\frac{3}{4}$ inch long and 2 lines apart, and the tertiary spinelets are 2 to 3 lines long; the leaves are suborbicular, broadly emarginate at the summit, and mucronate with 2 or 3 teeth on each margin: the petiole is seated in the sinus of a bidentate stipule. The flowers are numerous, and densely aggregated, owing to the very close proximity of the axils, so that the entire branch appears a full-flowered spike: the pedicels are somewhat more than a line long, the cylindrical tube of the calyx is $1\frac{1}{2}$ to 2 lines, and its segments $\frac{3}{4}$ to 1 line in length, its diameter being $\frac{1}{2}$ or $\frac{3}{4}$ line: the flowers are pale and membranaceous*.

16. *Colletia aciculata*, n. sp.;—ramosissima, intricatissime spinulosa, viridis, breviter et rigide pilosula; ramis rectis, subteretibus, ramulis decussatis, crebre spinosis, spinis iteratim spinulosis, spinulis brevibus, sulcato-striatellis, acute pungentibus; foliis in ramulis novellis minimis, obovatis, paucidentatis, glabris, viridibus, imo in petiolum brevem cuneatis, caducis; floribus infra spinulas superiores fasciculatis, et hinc spicam cylindricam oblongam multifloram mentientibus, pedicello calyce breviore, calycis tubo late cylindrico, submembranaceo, imo inflato, carnosulo, limbi laciniis 5 acutis, subreflexis, staminibus 5 exsertis.—Peruvia: *v. s. in herb. Mus. Paris,* sine loco aut designatione, No. 901 (sub. nom. "Retama," Dombey); Tarma (Dombey, "vern. Naqui").

Three specimens of this plant exist in the Paris Museum: the first, in flower, and the second, in fruit, are in the Jus-

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* This plant is represented in this work, Plate 36 B.

sieuan herbarium, both upon the same sheet as the original typical species of *C. spinosa*; and these are probably the identical plants which Poiret confounded together, in his description of the typical species, as being brought from Peru (Dict. Suppl. ii. 312): the third specimen was collected by Dombey at Tarma. It has much the habit of the preceding species, but its branches assume the appearance of a broader and more spreading spike: they are of a pale olive hue: the branchlets are straight and cylindrical, the primary spines are about ½ inch apart and 1¾ inch long; the secondary spines are 3 lines apart, and ½ to ¾ inch long; the tertiary spinelets are 2 to 3 lines long, all being clothed with fine sparse down. The inflorescence, owing to the closeness of the axils, covers the branchlets, each appearing like a densely flowered spike; the pedicels are 2 lines long; the cylindrical calyx, but little swollen, though tumid at the base, is 2½ lines, and the segments 1¼ line long, and 1¼ line diameter*.

17. *Colletia hystrix*, Clos, in Gay, Chile, ii. 32;—ramulis teretibus, rectis, rigidis, fuscis, pubescentibus, spinis brevibus, compositis, 3–4-natim verticillatis, secus ramos valde approximatis, et hinc intricatione formam longam cylindricam mentientibus, aut interdum nodos globosos interruptis emulantibus, omnibus pilis rigidis patentissimis vestitis, et apice calloso-pungentibus; ramulis novellis inermibus, et foliiferis, demum spinosis ct aphyllis: foliis parvis, ovatis, integris, aut obsolete dentatis, membranaceis, subglabris, 3-nerviis, apice mucronulatis, imo in petiolum brevem attenuatis; floribus sparsis, subfasciculatis, pedunculo tenui, calyce sicco pallide rosaceo, urceolato, medio constricto, imo globoso, limbi laciniis 5 reflexis, staminibus exsertis, filamentis erectis laciniarum quartæ longitudinis, stylo filiformi, longe exserto, stigmate capitato-3-lobo.—Chile centralis. *v. s. in herb. Mus. Paris*;—versus pedem Andium (Gay).

This is a very distinct species, partaking much of the habit of the following, and somewhat of the two preceding. Dr. Clos remarks that, seen at a distance, its branches bear much the appearance of a *Cactus* or *Cereus*, owing to the length of its straight branchlets, and the extreme intricacy of its innumerable spines, and verticillated very short ramifications. The leaves are oval, rounded at the summit, cuneated at base into a short petiole: they are glabrous, toothed on the margins, 2½ lines long, 1½ line broad, on a petiole of ½ line; the flowers are small and few, the pedicel is 1½ line long, the tube of the calyx

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* This species is shown in Plate 36 c.

1½ line, and the segments ¾ line long, and it is one line in diameter, tumid and semiglobose at its base*.

Var. β. Valanzuelæ; Colletia Balanzuelæ, *Bert. MSS.*: differt spinis acicularibus, tenuioribus, et paulo longioribus.

18. *Colletia ulicina*, Gill. et Hook, Bot. Misc. i. 155. tab. 44 c; *idem.* iii. 173;—suffruticosa, orgyalis, vel sub-2-orgyalis, ramosissima, ubique rigide hirsutula, ramis teretibus, elongatis, ramulisque spinosissimis, et intricatione spinarum quasi cylindraccis, spinis duplo aut triplo spinulosis, aut oppositis, vel ternatim verticillatis, spinulis crebris, brevibus, tenuibus, decussatis, fusco-olivaceis, striatis, acutissime pungentibus; foliis abortivis; stipula minuta, subulata, fusca, ciliata, tuberculoque florifera sub spinula enatis; floribus copiosis, plerumque fasciculatis, rarius solitariis, et proximitate axillarum hinc spicato-congestis; pedunculo hirsuto, incurvo, flore subæquilongo; calycis tubo elongato, cylindrico, infra medium constricto, imo subgloboso, fauce ampliore, limbi laciniis 5 oblongo-ovatis, recurvulis, staminibus intra tubum paulo supra medium insertis, omnino inclusis, filamentis brevissimis, stylo tubo multo breviore, erecto, stigmate subcapitato, obsolete 3-lobo; fructu pisi magnitudine.—Chile, in Andibus.—*v. s. in herb. Hook.* fluv. Tinguiririca, alt. 3000 ped. (Gillies); Colchagua, in vallibus Andinis (Bridges, 1807); Chile (Gillies, 220); *in herb. Mus. Paris*, San Fernando, prov. Colchagua (Gay, 570).

This is a very distinct species, not only on account of its habit, but of its copious red flowers with an unusually elongated tube, and its included stamens: in all other species the insertion of the stamens is in the mouth, between the segments of the border; here they originate far within the tube. Sir W. Hooker, on the authority of Gillies, describes it as being only 1 or 2 feet in height, with decumbent stems; Bridges, on the contrary, says that it grows to the height of 6 or 10 feet, which is more probable. It is found also in Rancagua, where it bears the name of *Cruzero*, appearing as a short tree, with a somewhat slender stem. A decoction is there made from its branches by the natives, who use it as a purgative. It comes into bloom in December and January. The branchlets are straight and terete, the primary spines are ¼ inch apart, generally verticillate, and ½ inch long; the secondary spines are 4 lines long, and the tertiary spinelets about two lines long, and slender. In the Rancagua specimen, they are somewhat longer and stouter. The flowers are densely

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* A representation of this plant is given in Plate 36 D of this work.

aggregated, and cover the spicated branchlets; the pedicel is 1½ line long; the tube of the calyx is 3½ lines long, the lanceolate segments 1 line long, and it is 1 line in diameter[†].

Species exclusæ.

1. *Colletia affinis*, Clos. = *Retamilia stricta**.
2. —— *articulata*, Phil. = *Retamilia articulata**.
3. —— *australis*, Brongn. = *Discaria australis*, Hook.
4. —— *Chacaya*, Don. = *Ochetophila* 3-*nervis*, Pöp.
5. —— *crenata*, Clos. = *Notophæna foliosa**.
6. —— *discolor*, Hook. = *Notophæna discolor**.
7. —— *disperma*, DC. = *Microrhamnus*?
8. —— *Doniana*, Clos. = *Ochetophila* 3-*nervis*, Pöp.
9. —— *Ephedra*, Vent. = *Retamilia Ephedra*, Brongn.
10. —— *inermis*, Clos. = *Ochetophila* 3-*nervis*.
11. —— *infesta*, Brongn. = *Adolphia infesta*, Meisn.
12. —— *longispina*, Hook. = *Discaria longispina**.
13. —— *Maytenoides*, Griseb. = *Condalia Maytenoides* = *Sciadophila Maytenoides*, Phil.
14. —— *multiflora*, Moç. Sessè. = *Adolphia infesta*, Meisn.
15. —— *nana*, Clos. = *Ochetophila prostrata**.
16. —— *obcordata*, Vent. = *Retamilia obcordata*, Brongn.
17. —— *pubescens*, Brongn. = *Discaria australis*, Hook.
18. —— *serratifolia*, Vent. = *Notophæna serratifolia**.
19. —— *serratifolia*, Hook. = *Notophæna foliosa**.
20. —— *spicata*, Willd. = *Scypharia senticosa**.
21. —— *tetragona*, Brongn. = *Scypharia*? *tetragona**.
22. —— *tetrandra*, Clos. = *Trevoa Closiana**.
23. —— *tomentosa*, Phil. = *Notophæna tomentosa**.
24. —— *Tralhuen*, Bert. = *Talguenea costata**.
25. —— *Trebu*, Bert. = *Trevoa* 3-*nervis**.

2. NOTOPHÆNA.

I propose this genus for a separate group, with flowers distinguished by the same peculiarity as those of *Colletia*—the total absence of petals,—but differing from the latter genus in its habit, its copious foliage, and in the form of its disk, which resembles that of *Discaria*. It is also characterized by the peculiar feature before alluded to—the union of the base of the opposite stipules, which gives an appearance of an articulation at every node,—a peculiarity often seen also in the middle of the spines when they are foliiferous. The type of the genus is the *Colletia serratifolia* of Ventenat, from Chile; the other species

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[†] This species is shown in Plate 36 E.

are mostly from the southern parts of the same country, and one is from New Zealand: hence the generic name, from *νότος, auster*; *φαίνομαι, appareo*. They sometimes form very leafy shrubs, at other times low decumbent bushes, bare of spines. Here we generally see a spineless branchlet issuing from below each spine, and bearing both leaves and flowers, which quite confirms the supposition that the scaly tubercle seen in *Colletia* and other genera is only a very abbreviated or suppressed branchlet.

NOTOPHÆNA, gen. nov.;—*Calyx* urceolato-campanulatus, usque ad medium 4–5-fidus, laciniis reflexis, intus carina prominula calloque apicali notatis, æstivatione valvatis, imo demum circumscissus. *Petala* nulla. *Stamina* 4–5, tubo calycino inter lacinias inserta; *filamenta* filiformia, laciniis breviora, erecta; *antheræ* ovatæ, 2-lobæ, 2-loculares, loculis rima longitudinali antice hiantibus. *Discus* pateriformis, hypogynus, imo tubi adnatus, margine brevi, libero, crenato. *Ovarium* superum, globosum, sæpe pilosum, 3-sulcatum, 3-loculare; *ovula* in loculis solitaria, erecta. *Stylus* brevis, calycis tubum æquans. *Stigma* obtusum, breviter 3-lobum. *Fructus* siccus, subglobosus, cupula calycina discoque suffultus et adnatus, in coccos 3 resiliens; istis seminibusque ut in *Colletia*.

Suffrutices (vel arbusculæ) *Chilenses, Magellanici et Novæ Zelandici*, ramulis *decussatis, elongatis, spinosis vel sæpius inermibus*; foliis *oppositis, ellipticis, crenulato-dentatis, discoloribus*; floribus *parvis, infra spinas, axillaribus, pedunculatis, solitariis, vel fasciculatis.*

1. *Notophæna serratifolia*, nob. Colletia serratifolia, *Vent.* (*non Hook.*) *Hort. Cels.* 92. tab. 15; *DC. Prodr.* ii. 28; *Brongn. Ann. Sc. Nat.* x. 366; *Lam. Dict. Suppl.* ii. 312; *id. Illustr.* pl. 930. Rhamnus Spartium, *Dombey*;—ramosa, ramis ramulisque patentissimis, virgatis, sub-4-gonis, sublævibus, glaberrimis, parce foliosis, subspinosis, spinis longiusculis, foliosis, apice calloso-pungentibus, patentibus; foliis internodiis æquilongis, sæpe 3, fasciculatis, oblongis, vel lineari-oblongis, apice bisinuatis et mucronatis, imo in petiolum brevem attenuatis, breviter serrato-denticulatis, dentibus glanduliferis, crassiusculis, enerviis, utrinque glaberrimis, subtus pallide flavis, stipulis navicularibus, linea transversali prominente inter se nexis, nodis hinc quasi articulatis; floribus axillaribus, subsolitariis, pedunculo calyce longiore, filiformi; calycis tubo brevi, imo inflato, limbi laciniis 5, brevibus, reflexis, staminibus ori insitis, stylo exserto.—Chile.—*v. s. in herb. Mus. Paris*, "Pérou" (sine dubio erroneo), Dombey.

This species differs from the following, with which it has been

generally confounded, in its green, slender, almost herbaceous stems and branchlets, which are somewhat angular, spreading nearly at a right angle, quite glabrous, furnished with spines, and sometimes bare of leaves, in its fewer or more deciduous, smaller, and nerveless leaves, in its fewer and larger flowers, and its larger fruit. The internodes are from ½ inch to 1 inch apart, and are almost articulated at each axil by the stipular extension before described; the divaricated spines, decussating at each axil, are about the length of the internodes, and are foliiferous in their middle: in the younger floriferous branchlets, the spines are wanting at the nodes, from which one to three leaves spring on each side; the leaves are 4 to 7 lines long, 1½ to 2 lines broad, bearing small glandular teeth on the margin, of which three, more conspicuous than the others, terminate the apex.

The specimen from which this account is derived is the original type described by Ventenat; the flowers here have all fallen away, but the fruit remains, generally solitary in the axils; the peduncle is 5 or 6 lines long, and the 3-lobed capsule is about 3 lines in diameter *.

2. *Notophæna foliosa,* nob. Colletia serratifolia, *Hook.* (*non Vent.*) *var. β, foliosa, Bot. Misc.* iii. 173. C. crenata, *Clos, loc. cit.* 35. Rhamnus diffusus, *Clos, in Gay, Chile,* ii. 20;—arbuscula frondosa, ramis ramulisque haud patentibus, nonnullis spinescentibus, spinisque erectioribus, virgatis, teretibus, striatis, pallidis, aut sæpius fusco-rubris; ramulis novellis inermibus, erectiusculis, elongatis vel abbreviatis, foliiferis et floriferis, et infra spinas (ubi adsunt) nascentibus; stipulis oppositis, rubellis, latiusculis, breviter trigonis, concavis, apice 2-dentatis, imo linea transversali circa caulem connexis; foliis oppositis, ellipticis, vel oblongis, apice obtusis et mucronulatis, imo acutioribus, crenulato-dentatis, dentibus sæpius fere obsoletis, supra læte viridibus, subtus pallide glaucis, penninerviis, nervis fuscis anastomosantibus, glabris, vel sub lente parce puberulis, petiolo canaliculato, tenui; floribus 3, fasciculatis ex quaque axilla; pedunculo erecto, demum incurvo; calyceque glabro, urceolato, 5-fido; staminibus erectis, laciniis reflexis, æquilongis; ovario piloso, stylo glabro, longe exserto; fructu minore.—Chile.—*v. s. in variis herbariis*; Valparaiso (Cuming, 427–637); Valdivia (Bridges, 594); Concepcion (Germain, sub nom. *Trevoa 3-nervis*); *in herb. Mus. Paris* (Gay); Dombey, sub nom. *Rhamnus Chacay.*

This is a small tree, with rather virgate branches and an abundant foliage of small leaves, with long spines, or rather

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* A drawing of this species is given in Plate 37 A of this work.

branchlets having an apiculate termination; the branches are quite glabrous; the spines, ¾ to 1¼ inch long, are always articulated in the middle, and there floriferous; the fertile branchlets that spring from below them bear an abundance of flowers and leaves, with the axils approximated, so that the inflorescence appears somewhat spicated; these branchlets, though sometimes much longer, seldom exceed half an inch in length, bearing in each node two opposite sets of three fasciculated flowers and two opposite leaves; the leaves are from 6 to 9 lines long, 3 lines broad, on a petiole one line in length; those of the main branches are 1 inch long, and half an inch broad, the margins generally revolute, with crenated, almost obsolete teeth, and yellowish. The peduncles are nearly 2 lines long; the broad and urceolate tube of the calyx is 1 line long, its segments and erect stamens ¾ line in length; the small hypogynous disk, adnate to it, is slightly concave, green, smooth, fleshy, with a raised undulating margin, and is half as broad again as the very pilose ovary which it supports. The 3-coccous fruit is about 2 lines in diameter, and pilose: when the cocci spring out of their bed, which they do with a noise and much elastic force, their persistent cup is seen to be formed of three distinct and stout membranes,—the base of the calyx, the disk, and the adhering portion of the epicarp. The seeds are oval, dark brown, hard and polished, like those of *Colletia*. The stipules are very conspicuous, especially in the young floriferous branchlets; here they form in each axil a minute hollow navicular cup, with two erect, obtuse, ciliated, red, membranaceous lobes, connected with those of the opposite stipule by a short membranaceous vaginant sheath; the petiole springs out of the sinus between the lobes, and the three peduncles grow out of the hollow of the cup*.

Dombey's plant, labelled as from Peru, is beyond doubt from Chile. Germain's specimens were distributed under the name of *Trevoa 3-nervis.*

3. *Notophæna cognata*, n. sp.;—ramis elongatis, virgatis, angulato-striatis, glaberrimis, spinosis, spinis longiusculis, pungentibus, medio foliiferis; ramulis junioribus floriferis, sub spinis ortis eisque multo longioribus; foliis oppositis, elliptico-oblongis, crenato-serratis, basi latioribus vix acutis, e medio summum versus gradatim angustioribus, ibi obtusis et emarginatis, sub lente utrinque sparsim pilosulis, supra viridibus, subtus pallide glaucis, petiolo canaliculato, puberulo; stipulis vaginaque transversa conspicuis; floribus 2–4, fasciculatis, pedunculis elongatis, petiolo calyceque 2–4-plo lon-

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* This species, with analytical details, is seen in Plate 37 B.

gioribus, glabris; calyce glabro, tubo urceolato 4-fido, staminibus 4, laciniis paulo brevioribus, erectis; ovario piloso, stylo elongato, tubo longiore, glabro.—Insula Chiloë.—*v. s. in herb. meo* (Capt. King).

This species is intermediate between the foregoing and the following one, and is distinguished by its more slender branches, larger emarginated leaves, the greater length of its peduncles, and its tetramerous flowers. Its floriferous branchlets measure 3 or 4 inches, its spines about 1½ inch; its leaves are 1 inch long, ½ inch broad, on a petiole 2 lines in length; its peduncles are 3 lines long, the tube of the calyx 1 line long, the same in diameter, and the lobes of its border nearly of equal length*.

4. *Notophæna discolor.* Colletia discolor, *Hook. Icon.* 538; *Hook. fil. Flor. Ant.* ii. 255; *Rich. Voy. Astrol.* p. , pl. 14;—frondosa, glaberrima, ramulis teretibus, strictis, substriatis, fusco-rubris, spinosis, spinis patentibus, longiusculis, valde pungentibus, apicem versus foliiferis; ramulis junioribus florigeris sub spinis enatis, elongatis; foliis oppositis, oblongis obovatisve, obtusis, argute serrulatis, margine subrevoluto, in petiolum brevem attenuatis, supra viridibus, subtus pallide glaucis, fere enerviis; stipulis transversim nexis, 2-dentatis, dentibus linearibus, acutissimis, ciliatis; floribus parvis, subsolitariis, 4-meris; capsula 3-cocca pilosula. Patagonia.—*v. s. in herb. meo et Hook.*, Port Famine (Capt. King); *in herb. Mus. Paris,* Magellan (Voy. Astrolabe).

This is distinct from the two preceding species, in the smaller size of its obovate leaves, and its smaller flowers, as well as in the shape of its stipules. The discolorous feature of its leaves is common to every species of this genus. The spines are ½ to one inch long; the leaves are 5 lines long, 2½ lines broad, on a petiole barely one line in length; the peduncle is 2 lines long; the tube of the calyx is ¾ line long, the same in diameter, and its short revolute teeth are only ¼ line in length: the peduncle in fruit becomes thicker; it is then 3 lines long, and is deflected; the 3-coccous fruit is 2 lines in diameter; it is sometimes 4-coccous.

5. *Notophæna Magellanica,* n. sp.;—suffruticosa, inermis, sub lente pilosula, ramulis subangulatis, sub-4-gonis, axillis approximatis; foliis parvulis, ovato-oblongis, utrinque obtusis, vel imo subcuneatis, carnosulis, margine integerrimis, vel obsolete dentatis, supra nitidis, viridibus, subtus pallidis, nervis omnino immersis, petiolo brevissimo, stipulis præ-

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* A sketch of this plant is given in Plate 37 c of this work.

cedentis; floribus parvis, in axillis oppositis, utrinque 3, fasciculatis, 4-meris.—In Fretum Magellanicum.—*v. s. in herb. Mus. Paris,* Sandy Point (Lechler, 1029, sub nom. *Colletia discolor*); *in herb. Hook.,* Cordillera de Arauco (Lechler, 2994).

This is a well-marked species; its branchlets have a greyish bark; its axillary nodes are 4 or 5 lines apart, and in the young branchlets 2 lines apart; the leaves are simply opposite, 2½–3 lines long, 1¼ line broad, on a short petiole: the flowers are small, the peduncle being 1 line long; the calyx, including its segments, is of the same length, and ¾ line in diameter*.

6. *Notophæna tomentosa.* Colletia tomentosa, *Philippi, Linnæa,* xxviii. 618;—ramis cinereo-tomentosis; foliis parvis, obovatis, læte viridibus, pubescentibus, adpresse serratis: stipulis minutis, ovato-lanceolatis, fuscis; floribus subfasciculatis; pedunculis 1-floris, glabris, calycem glabrum æquantibus, calycibus tubulosis, dentibus reflexis tubum dimidium æquantibus; petalis nullis, staminibus styloque calycem æquantibus.—Chile, prope San Antonio, Prov. Valparaiso.

This diagnosis is copied from Dr. Philippi's description in the 'Linnæa,' as above quoted. The absence of spines, the want of petals, and other characters show not only that it belongs to this genus, but also that it is very closely allied to the preceding and following species.

7. *Notophæna Andina,* n. sp.;—suffruticosa, humilis, inermis, procumbens; ramulis lignosis, subtortuosis, nodosis, foliosis; foliis oppositis, e gemmulis axillaribus elongatis squamosis productis, ovatis, utrinque obtusiusculis, aut basi acutioribus, integerrimis, crassiusculis, ubique parce pilosulis, supra viridibus, subtus pallide glaucis, penninerviis, petiolo brevi canaliculato pubero; stipulis imo latis, rubris, 2-fidis, ciliatis, inter se connexis; floribus paucis, subaggregatis; pedunculo 1-floro, petiolo longiore, piloso, erecto; calyce rigide puberulo, limbo 5-fido, staminibus 5 laciniis dimidio brevioribus; ovario glabro.—In Andibus Chilensibus excelsioribus.—*v. s. in herb. Hook.* (e declivitate orientali, Bridges, No. 1208).

This species is well distinguished by its procumbent spineless habit and copious aggregated foliage; its stunted proportions are consequent on its lofty alpine growth. Its leaves grow out of elongated tubercles, or nascent branchlets, which probably in

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* This species is represented in Plate 37 D.

the following year become branches; these young shoots, owing to the near proximity of their axils, appear as if imbricated by the stipular appendages, and these axils bear flowers as well as leaves. The main stems also appear articulated at each node by their very conspicuous red stipules, which are similar to those of the other foregoing species. The leaves are 5 to 9 lines long, 4 to 5 lines broad, on a petiole 1 or 1½ line long; they are discolorous, as in all the others, but with darker immersed nervures below. The peduncle is 2 lines long, the tube of the calyx 1½ line, the segments in addition ½ line long*.

8. *Notophæna Toumatou.* Discaria Toumatou, *Raoul, Ch. Pl. Nouv. Zélande,* p. 29. Discaria Australis, var. apetala, *Hook. fil. Flor. Nov. Zeal.* i. 47;—Frutex suborgyalis, glaberrimus, ramis tortuosis, subprocumbentibus, cortice membranaceo laxo, ramulis diffusis, horizontalibus, teretibus, striatis, spinescentibus, spinis elongatis, patentibus, calloso-pungentibus; foliis parvulis, fasciculatis, e tuberculo squamoso infra spinam prodeuntibus, lineari-oblongis, obtusis aut acutis, in petiolo brevi spathulatis, integerrimis, glaberrimis, crassiusculis, supra viridibus, nitentibus, enerviis, subtus pallide glaucis, nervis violaceis immersis; stipulis minutis, petioliferis, 2-fidis, dentibus lanceolatis, erectis, oppositis, et transversim nexis; floribus 4–6, fasciculatis, foliis intermixtis, pedunculo pubescente, erecto, calyce puberulo, limbo 4-fido, staminibus 4, erectis, laciniis dimidio brevioribus.—Nova Zelandia.—*v. s. in herb. Hook.*, east coast and interior (Colenso); Foxhill (Dr. Monro): *in herb. Mus. Paris,* Akaroa (Raoul).

This plant approaches the nearest to Ventenat's typical species, owing to its very divergent, long and stout spines, and the smallness and paucity of its leaves, in which respects they both assume more of the habit of a *Colletia.* The branchlets are quite straight, its opposite and almost horizontally-spreading spines are ¾ to 1 inch long; four or more small leaves, and often as many flowers, are almost fasciculated upon a prominent squamose gemma that issues from below the base of each spine: the leaves are 4 or 6 lines long, 1½ line broad, on an extremely short and delicate petiole; the peduncle, the tube of the calyx, and the reflected lobes of its border are each one line long†.

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* This plant is drawn in Plate 37 E of this work.

† A figure of this species is shown in Plate 37 F.

Division 2. **Chænocarpæ.** Flores petaliferi; fructus capsularis, dehiscens.

3. DISCARIA.

This genus was first established by Sir W. Hooker in 1830, and was then distinguished from *Colletia* principally on account of its smaller, cup-shaped, hypogynous disk, having an entire border, and not being perigynous, with a very remarkable involute margin: this, and the presence of petals, were well-marked characters; but these exist also in other genera since then established, which are again signalized by other distinct features. The several species of *Discaria*, with two exceptions, seem to be limited to a region formed by the provinces which border the river Plate: they are all spinose in their habit, much resembling in appearance those of *Colletia*, and consist of undershrubs or low bushes, almost aphyllous, and generally glabrous. The peculiar character which distinguishes this genus from *Ochetophila* is that of its fruit, which here also is capsular, somewhat globular, and 3-lobed, and half imbedded in the enlarged fleshy disk conjoined with the strongly ribbed cupular base of the calyx. I have pointed out in *Colletia* the easy decortication of the upper portion of the epicarpous covering, which, at the period of dehiscence, breaks away by a transverse circumscissile line; here, on the contrary, where it is thicker in texture, and half coriaceous, it opens by radiating lines into three valves, which generally remain persistent upon the margin of the disk, and thus allow its three enclosed cocci to spring out and escape. The support of the fruit appears formed of two thickened adnate cups; the inner one, somewhat the longer, is the enlarged disk, surrounded by the detruncated base of the calyx, while in *Ochetophila* this appearance does not occur, as there the basal support is thin and almost membranaceous, and the disk, not exceeding the length of the calycine cup, is not manifest. For reasons assigned in their respective places, the following species, formerly placed here, are referred to other genera: *D. australis*, Hook., to *Ochetophila*; *D. pauciflora*, Hook. fil., to *Scypharia*; and *D. Toumatou*, Raoul, as already described, to *Notophæna*.

DISCARIA, Hook.—*Calyx* tubuloso-campanulatus, 8–10-nervis, limbi laciniis 4–5, acutis, reflexis, æstivatione valvatis, imo demum circumscissus. *Petala* 4–5, squamiformia, ovata, unguiculata, subconvexa, stamina amplectentia. *Stamina* 4–5, petalis vix breviora, et cum illis intra lacinias inserta: *filamenta* brevissima, erecta; *antheræ* reniformes, 2-loculares, rima hippocrepica antice dehiscentes. *Discus* pateriformis,

carnosulus, margine libero, crenulato. *Ovarium* oblongum, 3-sulcatum, disco breviter immersum, 3-loculare; *ovula* in loculis solitaria, erecta; *stylus* brevis; *stigma* obtuse 3-lobum. *Fructus* subglobosus, 3-sulcatus, in calycis cupulam valde 10-costatam discoque aucto adnatam semi-immersus, epicarpio crasso coriaceo persistente 3-valvato, endocarpio hinc secedente, in coccis 3 elastice resilientibus, axin versus bivalvatim dehiscentibus, singulis monospermis. Semen *Colletiæ.*

Suffrutices *in Provinciis Argentinis præcipue vigentes, rarius in Australasia,* ramis *valde patentibus,* ramulis *spinescentibus*; folia *parvula, breviter petiolata, spathulato-oblonga, infra spinas orta, fasciculata, valde decidua*: stipulæ *minutæ, 2-lobæ, laciniis subulatis*: flores 2–3, *fasciculati e turionibus spina brevioribus cum foliis prodeuntes*; pedunculo 1-*floro, nutante.*

1. *Discaria Americana,* Hook. Bot. Misc. i. 156. tab. 44 D. Condalia spinosa, *Spr. Syst. Cur. post.* iv. 108. Condalia megapotamica, *Spr. Linn.* xv. 473;—intricatissime spinosa, ramis tortuosis, ramulis compresso-teretibus, fere aphyllis, obsolete rigide pilosulis, spinis decussatim oppositis, iterumque spinulosis, striatis, subulatis, apice calloso-pungentibus; foliis minimis, oppositis, rarius 2–3 infra singulas spinas enatis, oblongis, obtusis, serratis, imo in petiolum brevem cuneatis, reflexis, caducissimis: stipulis minimis, rudimentariis, rubris, obsolete 2-dentatis intus pilosulis; floribus 2–3, fasciculatis, nutantibus, e tuberculo sub spina stipula suffulto ortis; calyce urceolato, limbo 5-fido, petalis 5, oblongis, concavis, unguiculatis, staminibus 5 petalis paulo longioribus, et laciniis 3-plo brevioribus, erectis, filamentis brevibus, antheris ovatis, ovario oblongo, 3-sulcato, glabro, stylo calycis dimidio longitudinis, fructu 3-cocco, calycis cupula valde 10-sulcata suffulto.—Portozuelo Prov. Cordovæ (mihi lecta); in radicibus montium Prov. San Luiz et Cordova (Gillies).

I cannot find in the Hookerian herbarium the typical plant upon which Sir William Hooker founded this genus, nor any other approaching its characters; it was probably a unique specimen that remained in Gillies's own collection, which was afterwards sold and dispersed. In one of my journeys over the Pampas I found a plant in the same locality in which Gillies met with his, so that I may safely consider mine as referable to the same type, notwithstanding the want of flowers for its complete identification: it is only in fruit. The floral character given above is therefore derived from Sir Wm. Hooker's figure, which closely resembles that of the following species, which I received from Tweedie. In its intricately spinose habit, it has

quite the appearance of a *Colletia*; the spinules generally are from 6 to 9 lines long, the internodes being somewhat shorter; the leaves, including the petiole, are only 1 line in length, and half a line in breadth; they are deflected, naviculate, with a recurved apex. In Sir Wm. Hooker's figure, the peduncle is 1 line long, the tube of the calyx is 2 lines long, the same in diameter, and the border-segments half that length; the disk, adnate to the bottom of the calyx, has a narrow, free, crenulated margin. The peduncle in the fruit is much thickened, striated, and elongated to 2 lines; the capsule is globular, somewhat depressed, 2 lines in diameter, half imbedded in the persistent cup of the calyx, which is of a fuscous reddish hue, is 10-ribbed, and glabrous; the free rim of the adnate intermediate disk runs parallel above the margin of the cupuliform base of the calyx; the thick and somewhat coriaceous epicarp of the capsule splits along its grooves in the form of three persistent valves, owing to the pressure of the three cocci, which thus escape from their enclosure with an elastic spring; these cocci are thin and horny, splitting along the line of the central axis, and partly along that of the dorsal face, exactly after the manner of the *Euphorbiaceæ**.

2. *Discaria Lycioides*, n. sp.; ramulis substrictis, simpliciter spinosis, spinis decussatim oppositis, teretibus, illis præcedentis gracilioribus, glabris, striatis, inter strias granuloso-punctulatis, apice calloso-pungentibus, rarius spinulis secundariis armatis; turionibus (ramulis novellis) spina tertia parte brevioribus, foliiferis et floriferis sub spinis superioribus singulatim ortis, foliis crebritate axillarum, hinc fere fasciculatis, sed vere oppositis, oblongis, remote serratis, apice mucronulatis, imo in petiolum tenuem cuneatis, glaberrimis, caducis: stipulis minimis, mucroniformibus, oppositis, sub spinis inter se linea transversali nexis; floribus e turionibus 2–4, et proximitate istorum apicem versus ramorum, hinc densiter spicatim congestis; pedunculo flore breviore; calyce urceolato, limbi laciniis 4, triangularibus, erectis, apice recurvulis; petalis 4, illis dimidio brevioribus, elliptico-ovatis, imo late spathulatis, paulo concavis; staminibus eorum longitudine; antheris ovalibus; stylo incluso; stigmate capitato-3-lobo.—Banda Oriental.—*v. s. in herb. meo* (Tweedie): *in herb. Mus. Paris*, Rio Grande (St.-Hilaire, 1873; Gaudichaud, 1638).

This plant is very like a *Lycium* in habit; its branches are straighter than in the preceding species, and are quite glabrous; its opposite spines are spreading, $\frac{5}{8}$ or $\frac{3}{4}$ inch long and $\frac{1}{2}$ an inch apart; the lower ones are bare, but towards the extremities of

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* This plant is shown in Plate 38 A of this work.

the branches, beneath each spine, an elongated sprout or suppressed branchlet occurs about 3 lines long, which is imbricately squamose, owing to the decussating stipules of the approximated axils; from these, both opposite leaves and flowers issue in great abundance, which thus appear fasciculated, and in this manner the extremities of the branches assume the aspect of dense spikes, richly covered with flowers. The leaves are 3 lines long, 1½ line broad, on a slender petiole of half a line in length; they are somewhat fleshy, serrated on the edges, deeply retuse, and mucronate at the apex; the peduncle is above a line long; the calyx, including the short erect segments, is 2 lines long, and 1½ line in diameter, and is of a reddish hue; the stamens are almost sessile in the sinus of the segments, and they, as well as the small scale-like petals, are only half the length of the segments *.

Var, *β*, *exilis*: glaberrima, ramulis gracillime vimineis, spinosis, spinis remotioribus, elongatis, tenuiter acuformibus, et interdum spinulosis: floribus in axillis subsolitariis.—Buenos Ayres.—*v. s. in herb. Mus. Paris*; *in herb. Jussieu* (Commerson); *in herb. Soc. Linn. Lond.* (a Jussieu missa).

This is of an extremely slender growth, and I consider it to be merely a variety of the above species; its leaves are deeply serrated, and its flowers somewhat smaller: the internodes are 6 to 8 lines apart, the needle-like spines are 9 to 12 lines long, and the spinelets 3 or 4 lines; the opposite leaves are 4 lines long, including the short petiole, and 1 line broad; the flowers, like those in Tweedie's specimen, are of a reddish colour; the peduncle is 2 lines long; the calyx, including its four segments, is 2 lines long, and, in like manner, the almost sessile erect anthers and scale-like petals are barely half the length of the short triangular segments †.

3. *Discaria longispina*. Colletia longispina, *Hook. Arn. Bot. Misc.* iii. 173;—fruticosa, glaberrima, fere aphylla, ramis ramulisque virgatis, spinosis, spinis oppositis, remotis, longissimis, sæpe arcuatis, patentibus, sæpius nudis, calloso-pungentibus: ramulis novellis sub spinis enatis, axillis decussatis foliiferis et floriferis; foliis oppositis, parvulis, elongato-ellipticis, acutis, integerrimis, rarius apice denticulatis, imo gradatim cuneatis, nitentibus, viridibus, carnosulis, nervis immersis; stipulis minutis, rubris, ovatis, apice acute 2-dentatis, longe albido-ciliatis, linea transversali sub spinis inter se

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* A representation of this species is given in Plate 38 B of this work.

† This variety is represented in Plate 38 C.

connexis; floribus proximitate axillarum, hinc sæpe densiter congestis; pedunculo calyci æquilongo; calyce late urceolato, limbi laciniis 4, erectis, petalis 4, ovalibus, utrinque acutis, subconcavis, laciniis subæquilongis; staminibus petalis vix brevioribus, ovario in fundo disci crateriformis adnati margine liberi insidente, depresse globoso, 3-sulcato, glabro; stylo incluso, fructu subgloboso, calycis cupula crassa suffulto, coccis 3 secedentibus, epicarpio persistente 3-valvatim dehiscente.—In Provinciis Argentinis.—*v. s. in herb. Mus. Paris, in herb. Jussieu* (Commerson); Monte Video (Gay); Rio Grande (Gaudichaud, 1617): *in herb. Hook.*, Buenos Ayres (Tweedie, 1378); Puerto Bravo (Tweedie); Bahia Blanca (Darwin); Maldonado (Capt. King); Banda Oriental (Baird).

This differs from the preceding species in its longer and more vimineous branches, its more distant nodes, and the much greater length of its spines; its flowers also are smaller, paler, and more lobular. The floriferous gemmæ are lengthened into more distinct branchlets, with more remote decussating axils: the spines generally attain a length of 1½ inch,—sometimes, as in Commerson's specimen, they are shorter; while in that from the Banda Oriental they are 2½ inches long: the leaves are usually 3 lines long and 1 line broad, but occasionally they attain a length of 5 lines: the floral peduncle is 1 or 2 lines long; the calyx, including its border, is 2½ lines long and 1½ line in diameter; it is thin in texture, and of a pale yellow colour, probably white in the living state; the fruit and peduncle are of the size of those of *D. Lycioides*, but the persistent portion of the calyx is dark red and smooth*.

4. *Discaria spiculata*, n. sp.;—suffruticosa, glaberrima, ramulis teretibus, subcompressis, decussatim spinosis, substriatulis, fusco-viridibus, fere aphyllis; spinis subulatis, validioribus, apice calloso-pungentibus; foliis parvulis, e gemmis elongatis per paria enatis, mox caducis, oblongis, utrinque acutis, carnosulis, fere integris, enerviis, glaberrimis; stipulis oppositis, rudimentariis, acutis, sub spinis non inter se connexis; floribus solitariis, glabris, pedunculis calyce sub-brevioribus, calyce campanulato-cylindrico, subbrevi, limbi laciniis 4, dentiformibus, erectis, apice callo carnoso incrassatis, petalis minimis, laciniis 4-plo brevioribus, ovatis, utrinque acutis, subconcavis, erectis; staminibus 4, petalis æquilongis, filamentis brevissimis, antheris ovatis; disco adnato, patelliformi; ovario glabro, oblongo, stylo medium tubi attingente; fructu immaturo

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* A drawing of this species is given in Plate 38 D.

globoso, 3-lobo, calycis cupula semicincto.—Circa Buenos Ayres.—*v. s. in herb. Soc. Linn.* (Commerson).

This is another species, existing in the herbarium of the younger Linnæus, with a ticket in his hand-writing, "Circa Buenos Ayres—Commerson." It bears some resemblance in its general habit to *D. Lycioides*, but its spines are shorter and thicker, and its flowers are only one-fourth the size of those of that species. The leaves, including the petiole, are about 2 lines long, the peduncle 1 line, the calyx, including its teeth, 1½ line long, and 1 line in diameter. The spinules are from 3 to 5 lines in length*.

Var. *β. gracilenta*;—ramulis gracillimis, spinis nudis, remotis, acicularibus, patentibus; foliis lineari-oblongis, imo in petiolum spathulatis, integris vel summo 2-dentatis et emarginatis, discoloribus; stipulis linea transversali nexis, nodis hinc quasi articulatis: floribus solitariis, pedunculo folio æquilongo.—In Prov. Argentinis?—*v. s. in herb. Soc. Linn. Lond.*

This plant is likewise in the herbarium of the younger Linnæus, without any locality or designation, and is probably also from Commerson's Collection; it has more slender branches than the preceding, and longer needle-like spines, and the nodes are almost articulated; its leaves and flowers, too, are more minute. Its very slender spines are 1 inch long, and half that distance apart: the floriferous branchlets are only ¼ or ⅜ inch in length; its leaves (including the petiole of ½ line) are 2 lines long, ½ line broad; the peduncle is 1 line line; the calyx is ¾ line long, and ½ line in diameter†.

5. *Discaria australis*, Hook. Bot. Misc. i. 157, tab. 45 A; Journ. Bot. i. 256; Hook. fil. Flor. Tasm. i. 69. Colletia pubescens, *Brongn. Ann. Sc. Nat.* x. 366. Colletia Cunninghami, *Fenzl, Pl. Hug.* 23. Tetrapasma juncea, *G. Don, Dict.* ii. 40;—suffruticosa, dumosa, ramulis erectis, virgatis, junceis, valde spinosis, pubescentibus, adultioribus fere glabris, subaphyllis; spinis internodio æquilongis, decussatim oppositis, patentibus, subulatis, calloso-pungentibus; foliis oppositis, lineari-oblongis, imo cuneatis, integris, acutis, aut summum versus serrulatis, apice mucronatis, crassiusculis, margine cartilagineo subrevoluto, obscure 3-nerviis, nervis omnino immersis, superne viridibus, subtus flavide glaucis, petiolo brevi; stipulis parvis, oppositis, apice 2-dentatis, sinu petioliferis, imo latis, sub spinis linea transversali nexis; floribus plurimis, e

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* This species is represented in Plate 38 E of this work.

† A sketch of this variety is given in Plate 38 F.

gemma squamosa elongata parvis, congestis, glabris; pedunculo brevi, tenui, calyce suburceolato, 4-dentato, dentibus tubo æquilongis; petalis 4, lineari-oblongis, dentium calycinorum dimidio longitudinis; staminibus totidem, e basi petalorum introflexis; disco poculiformi, adnato, margine undulato latiusculo libero; ovario depresso, in discum semi-immerso, glabro, stylo brevissimo, incluso; fructu parvo, 3-cocco. —In Australasia et Tasmania.—*v. s. in herb. Hook.*, Cox's River et Port Jackson (A. Cunningham); in interioribus (M'Arthur); Loddan (F. Müller); Great Swanport (Backhouse); Norfolk Plains, Tasmania (Gunn).

This plant, in its general habit and floral characters, quite agrees with all the foregoing species; but it differs from them in the more membranaceous epicarp of its capsule, which splits near the margin of the cupuliform disk, and remains attached to the resilient cocci, as in *Colletia* and *Ochetophila.* It grows in sandy places, forming a mean-looking bush, 2 or 3 feet high; its branches are virgated and spinose; its spreading spines measure ½ inch to 1½ inch; the leaves are 4 to 6 lines long, 1½ line broad, on a petiole ½ line in length; the peduncle is slender, and 2 lines long; the calyx, including its segments, measures only 1 line in length and in diameter.

4. OCHETOPHILA.

This genus, proposed, but not published, by Pöppig, was first described by Endlicher, in his Gen. Plant. (No. 5733), founded upon the *Sageretia trinervis* of Gillies, and comprising two other plants from Chile, which were designated by name only, and are still undescribed. It is distinguished from *Discaria* by many slight characters, among which is the form of its peculiar stipules. In the latter genus, the petiole springs from the sinus between the teeth of each retinaculoid stipule, the margins of which are connected with those of the opposite stipule by a transverse line. In *Ochetophila,* the petioles of the opposite leaves spring directly from the branch; they widen at their base, and embrace the stem so far that their edges meet together in the middle of the node, giving it an articulation of a character different from that in *Discaria*: in each axil above the base of the petiole is seen a broad, concave, somewhat erect, dark red, scale-like stipule, which is bifid at its apex, with ciliated margins. The structure of its flower much resembles that of *Discaria,* and the shape and formation of its fruit are similar: its petals, however, are proportionally larger, more cucullate, and they often completely hide the stamens; the free portion of the filaments is comparatively longer; the disk is like that of *Discaria.* The flowers are more numerous, and are supported by longer peduncles. Its capsule resembles that of *Colletia*, being half imbedded in the simple cupular base of the calyx, while in *Discaria* it appears to be surrounded by two thickened cups, the inner one being somewhat longer, originating in the growth of the adnate disk, and the protrusion of its free margin beyond the cup of the calyx: on the contrary, in *Ochetophila*, the cupuliform support is thin and almost membranaceous, and the disk is not discernible, owing to its not exceeding the length of the cup of the calyx. All the species differ in their habit from *Discaria*; they often form good-sized trees, and their branches are rarely furnished with spines, although their extremity is generally sharp-pointed; they are copiously furnished with leaves, which are much larger and three-nerved.

The typical species above mentioned is the *Rhamnus Chacaya* of Dombey, erroneously stated to have been brought from Peru; it grows abundantly near the margins of streams in the elevated valleys of the Andes, and these localities are hence called "los Chacayes," from the vernacular name of the tree. In general appearance it resembles *Notophæna foliosa*, and the two are commonly confounded in herbaria; but the absence of petals in the latter genus constitutes an essential difference. Its generic name is evidently derived from the circumstance that its species are usually found near running streams; those of *Discaria* prefer, on the contrary, dry, saline, and sandy situations. The character of the genus is here remodelled as follows:—

OCHETOPHILA, Pöp.—Char. emend.—*Calyx* petaloideus, urceolato-campanulatus, usque ad medium 4–5-fidus, laciniis acutis, intus carinatis, calloque sub apice signatis, reflexis, æstivatione valvatis. *Petala* 4–5, oblonga, cucullata, imo attenuata, laciniis calycinis æquilonga, et cum staminibus in sinubus inserta. *Stamina* 4–5, petalis recondita; *filamenta* subulata, tenuia, erecta, apice inflexa; *antheræ* parvulæ, ovatæ, 2-lobæ, imo profunde cordatæ et divaricatæ, apice dorsi affixæ, lobis singulatim 2-valvulatis, valva antica breviore et hinc rima hippocrepica hiantibus. *Discus* carnosus, late pateriformis, calyci omnino adnatus, margine vix libero, integro vel subcrenato. *Ovarium* depresso-globosum, 3-sulcatum, liberum, medio disci insitum, et eo vix immersum, 3-loculare; ovula in loculis solitaria, erecta. *Stylus* calyce dimidio brevior, 3-sulcatus, glaber. *Stigma* obtuse 3-lobum, lobis paulo divaricatis. *Fructus* globosus, *Notophænæ* similis. Semen *Colletiæ*.

Frutices *arborescentes et erecti vel demissi et decumbentes, in Andibus Chilensibus vigentes, foliatione et inflorescentia ut in* Notophæna, *sed stipulis diversis.*

1. *Ochetophila trinervis,* Pöp., Endl. Gen. No. 5733.—O. Hookeriana, *Reiss. in Gay, Chile,* ii. 39.—Sageretia 3-nervis, *Gill. et Hook. Bot. Misc.* iii. 172.—Colletia inermis, *Clos in Gay, Chile,* ii. 36; C. Doniana, *Clos, loc. cit.* ii. 36.—C. Chacaye, *G. Don, Dict.* ii. 35.—Rhamnus linearis, *Clos, loc. cit.* ii. 21. Rhamnus Chacaya, *Domb.*;—arbuscula 2–3-orgyalis, glabra; ramis teretiusculis, ramulis teretibus, subvirgatis, subpendulis, valde foliosis, inermibus, vel apice interdum spina terminatis; foliis oppositis, elliptico- vel lanceolato-oblongis, obtusiusculis et mucronulatis, integerrimis, supra viridibus, subtus glaucis, imo in petiolum brevem decurrentibus, 3-nerviis, nervis lateralibus margine parallelis, eveniis; stipulis intrapetiolaribus, latis, erectis, 2-dentatis, ciliatis, utrinque in lineam transversalem connexis; floribus subternis, fasciculatis, folio multo brevioribus, 4-meris, rarius 5–6-meris, pedunculo imo bracteato, glabro, calycis tubo urceolato, quam pedunculus 2-plo breviore, laciniis reflexis, tubo æquilongis, petalis oblongis, concavis, late unguiculatis, erectis, longitudine laciniarum; fructu parvo, 3-cocco.—In Andibus Chilensibus.—*v. v.* locis humidis in vallibus circa Mendozam (los Chacayes dictis).—*v. s. in herb. Hook.*; Chile, La Guardia (Gillies, Cuming, 242); Chile (Bridges, 142).—*in herb. meo*; Cordillera de Maule (Germain).—*in herb. Mus. Paris*; Cauquenes (Gay, 359); Cordillera del Hurtado, alt. 2015 met. (Gay, 525).

This species has an extensive range along the skirts of the Cordillera; but I doubt its existence near the sea-coast, though Bridges's specimens are referred to as from Valparaiso, that being the place whence they were sent: this error of locality is frequent among the specimens of Bridges and other collectors. Its range extends as far to the southward as Concepcion, where it forms a tree 18 feet in height, with a trunk 18 inches in diameter, the wood being very durable, even in the ground; for which reason it is used in building the cottages of the natives: an infusion of its bark is also employed there in the cure of ulcerous swellings. I met with it on the eastern side of the Andes, where it forms a pretty tree, with long, slender, pendent branches, with abundant delicate foliage, and copious small white flowers. Its leaves, with three parallel prominent nervures, are from 6–9 lines long, 2–3 lines broad, on a slender petiole 1 line in length: the pedicels are 2–2½ lines long, slender, the flowers being a line in length, and the same in diameter; the capsule is 1½ line diam. The specimens from Germain's collection, distributed as the *Rhamnus linearis,* Clos, belong to this species *.

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* A drawing of this species is given in Plate 39 A of this work.

2. *Ochetophila prostrata*, n. sp.;—Colletia nana, *Clos in Gay, Chile*, ii. 37;—fruticosa, humilis, inermis, ramis nodosis, cortice nitido solubili; ramulis brevibus valde foliosis; foliis parvulis, oppositis, creberrime aggregatis, spathulato-ovalibus, obtusis, integerrimis, crassiusculis, margine subrevoluto, supra pallide viridibus, utrinque bullato-resinosis, brunneo-maculatis, rigide pilosulis, subtus hepaticis, longius pilosis, petiolo brevi canaliculato; stipulis 2-dentatis, intrapetiolaribus, erectis, acutis, rigide ciliatis; floribus axillaribus, solitariis, glaberrimis, proximitate foliorum quasi aggregatis, pedunculo folio fere æquilongo; calyce cylindrico, imo inflato, limbi laciniis 4, acutis, reflexis, tubo tertia parte brevioribus; petalis 4, laciniis brevioribus, oblongis, erectis, concavis, unguiculatis; staminibus totidem e basi introflexis; antheris ovato-rotundis, medio dorsi peltatim affixis; disco crateriformi, margine integro; ovario subgloboso fundo disci insito, 3-sulcato; stylo brevi incluso.—In Andibus Chilensibus excelsioribus.—*v. s. in herb. Hook.*, declivitate orientali (Bridges, 1209).—*in herb. Mus. Paris*, Chile (Gay); specimen typicum *Colletiæ nanæ*, Clos.

This is an alpine shrub, of diminutive size and prostrate growth, with an abundance of small foliage and with copious small pendent flowers; it is closely allied to the preceding species, but has a more cæspitose habit, with much longer peduncles, and a longer calyx. Its leaves, including the short petiole, are 3 lines long and 1 line broad; those of the flowering shoots are only half this size: the stipules are very conspicuous, differing from those of *Discaria* and *Notophæna* in being intrapetiolar, while the margins of the opposite petioles are continued in a transverse line across the stem: the peduncles are 1–2 lines long; the tubular calyx, somewhat contracted in the middle, is 1½ line long, the lobes of its border being ½ line in length. Bridges's specimen corresponds with Dr. Clos's *Colletia nana* *.

3. *Ochetophila parvifolia*, n. sp.;—suffruticosa, humifusa, ramosa, inermis, ramis validioribus, cortice nitido solubili, ramulis brevibus aut longioribus, nodis subarticulatis, approximatis, foliosis; foliis subfasciculatis, minimis, spathulato-ovatis, obtusis, integerrimis, carnosulis, navicularibus, infra subcarinatis, enerviis, pallide viridibus, glaberrimis, utrinque bullato-resinosis et brunneo-punctatis, petiolo brevi, canaliculato; stipulis oppositis, rubellis, ut in præcedente; floribus paucis; calyce urceolato, tubo subbrevi, limbi laciniis 4, acutis; petalis 4, laciniis multo brevioribus, cucullatis; staminibus

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* This plant is figured in Plate 39 B.

totidem iis brevioribus; antheris ovalibus; ovario 3-lobo, in fundum disci crateriformis insito; stylo brevi, stigmatis lobis 3, arcte adpressis.—In Andibus Chilensibus excelsioribus.—*v. s. in herb. Hook.*, Cordillera, in præaltis (Bridges).

This also is a dwarfish species, which attaches itself to the surface of rocks, like the preceding species; but it appears to be somewhat more erect, with stouter and straighter branches, which are closely beset with very short branchlets, all covered with shorter, more numerous, and more minute leaves. In the specimen above cited, the flowers are only in bud, and few are developed; these, however, are sufficient to show their structure. The leaves, with their petioles, scarcely exceed 1½ line, or at most 2 lines in length, and 1 line in breadth. The flowers are smaller than in the preceding species. It has much the habit of the *Rhamnus microphyllus* of Kunth (tab. 616), but with still smaller leaves*.

4. *Ochetophila riparia*, Pöpp. MSS.

5. *Ochetophila divergens*, Pöpp.

No description has yet been given of these two species, their existence only being indicated in Endlicher's 'Genera Plantarum' (No. 5733), where they are stated to have been found by Pöppig in Chile.

5. Adolphia.

This must be considered in some degree as an aberrant genus of the *Colletieæ*, amongst which it has been placed by Endlicher. My reason for this doubt is founded on the structure of its calyx, which is cleft down to the limit of the adnate disk, the consequence of which is that the stamens appear to originate outside the margin of the disk, as in the *Rhamneæ*, thus divesting it of one of the peculiar and distinctive characters of the *Colletieæ*; on the other hand, the species on which the genus is established has opposite leaves,—a feature rarely or imperfectly developed in the *Rhamneæ*. I have also noticed, in the structure and mode of dehiscence of the anthers, another character found in some of the genera that follow, which I do not see recorded of any species of the *Rhamneæ*. Dr. Asa Gray remarks (Pl. Wright. p. 34) that *Adolphia* hardly differs from *Colubrina*, which may be true in some degree, as far as regards the structure of the flower; but that genus has alternate leaves. *Ceanothus* is in the same category, although its fruit, as in *Colubrina*, is said to be exactly like that of *Colletia, Adolphia,* and some other genera of the *Colletieæ.* Brongniart's remark* on this point is more conclusive; for he states that *Adolphia* differs from *Ceanothus* and *Colubrina* in the form of its calyx and petals, its simple style, opposite leaves, and spinose branchlets, which are all floriferous below.

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* A representation of this species is given in Plate 39 c.

Adolphia, Meisn.—*Calyx* campanulatus, brevis, ultra medium 5-fidus, laciniis acutis, intus carinatis et callosis, æstivatione valvatis. *Petala* 5, ovata, cucullata, imo unguiculata, stamina amplectentia. *Stamina* 5, inter lacinias calycinas cum petalis infra marginem disci inserta; *filamenta* complanata, erecta, apice inflexa; *antheræ* rotundatæ, cordatæ, 2-lobæ, connectivo reniformi dorsali affixæ, rima hippocrepica 2-valvatim dehiscentes, et hinc demum peltatim apertæ. *Discus* crateriformis, carnosulus, magnitudine tubi calycis, et ei arcte adnatus. *Ovarium* in fundum disci insitum, et paululo immersum, depresso-globosum, 3-loculare; *ovula* in quoque loculo solitaria, erecta. *Stylus* brevis; *stigma* obtusum, 3-lobum. *Fructus* capsularis, 3-coccus, ut in *Colletia.*

Frutex *Mexicanus, ramosissimus, spinosus,* ramulis *oppositis, teretibus, sæpius spina terminatis*; spinis *patentibus, decussatim oppositis, rigidis*; folia *opposita, longe linearia, integerrima*; flores *solitarii, axillares, quasi fasciculati.*

1. *Adolphia infesta,* Meisn.; *Benth. Pl. Hartw.* 286; *A. Gray, Pl. Wright.* 34.—Colletia infesta, *Brongn. Ann. Sc. Nat.* x. 366.—Ceanothus infestus, *H. B. K.* ii. 31.—Colubrina infesta, *Schl. Linn.* xv. 468;—Frutex 3–4-pedalis, ramosissimus, spinosissimus; ramis ramulisque patentibus apice spinescentibus, junioribus retrorsum hirtellis, spinis decussatis; foliis parvis, oppositis, anguste lanceolatis, apice mucronatis, integris, crassiusculis, pilosulis, demum glabrescentibus, subtus pallidioribus, brevissime petiolatis; stipulis parvis, oppositis, gibbosis, squamiformibus, fusco-rubellis, 2-fidis, laciniis lineari-acutis, erectis, ciliatis, sinu petioliferis; floribus 2–6, in gemmam squamosam congestis.

Hab. Mexico.—*v. s. in herb. Hook.,* Zacatecas (Coulter, 10); El Paso, Nov. Mex. (Wright, 91).

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* Ann. Sc. Nat. x. 367.

Division 3. **Clithrocarpæ.** Flores petaliferi; fructus nucamentaceus et lignosus aut membranaceus, fere semper indehiscens.

6. RETAMILIA.

This genus is very distinct from all others of this tribe, differing in its peculiar virgate habit, its almost aphyllous Ephedra-like erect branches; the reduction of its disk to the size of a mere torus, or stipitate support of the ovary; and its large, spherical, thick, nuciform fruit. The name of *Retanilla* was first applied (in 1825) by DeCandolle, in his Prodromus (ii. 28), to a section of the genus *Colletia,* under which he arranged two plants, distinguished from others of that genus by the presence of petals and the absence of the conspicuous disk: these were the *Rhamnus Retamilla* and *Rhamnus Ephedra* of Dombey, both collected by him in Chile,—Ventenat having previously described both plants as species of *Colletia.* Brongniart (in 1827) adopted the suggestion of DeCandolle, in his Monograph of the *Rhamnaceæ,* and established the genus *Retanilla* for the same plants, making the type of his genus the *Colletia obcordata,* Vent. (identical with *Rhamnus Retamilla,* Domb.).

There has been an error, originating with DeCandolle (Prodr. ii. 28), in converting Dombey's Spanish name, *Retamilla,* into *Retanilla,* the former being the diminutive of *Retama,* or common Broom of Europe, which resembles the Chilean plant in its almost leafless virgate stems; but, as the Spanish *ll* has invariably a liquid pronunciation, it is desirable to correct the spelling in harmony with it, and thus *Retamilia* becomes the more appropriate name. One of the peculiarities of the genus consists in the structure of its fruit, which is much larger than in any other genus of the tribe, is somewhat drupaceous, with a fleshy epicarp that becomes coriaceous, and incloses a hard, ligneous, indehiscent nut, the partitions between its cells being very thick and woody; it is smooth, with three slight furrows, corresponding with the lines of the dissepiments; the transverse disposition of the woody fibres of the thick endocarp appears a constant character, worthy of notice. As previously mentioned, Brongniart quotes this as one of the few genera of the *Rhamnaceæ* in which stipules are wanting; but in all the specimens I have seen they are certainly developed in the manner peculiar to most of the *Colletieæ.* The generic character is emended in the following manner:—

RETAMILIA, Brongn. *Molinæa,* Comm.—*Calyx* tubuloso-campanulatus, carnosulus, limbo 4–5-fido, laciniis triangularibus, erectis, intus carina calloque apicali notatis, æstivatione val-

vatis, tubo infra medium intus piloso, pilis patentibus, demum caducus. *Petala* 4–5, erecta, laciniis alterna et æquilonga, ore tubi cum staminibus inserta, obovata, unguiculata, concava, cucullata. *Stamina* 4–5, petalis opposita et iis recondita; *filamenta* subulata, glabra, apice inflexa; *antheræ* rotundatæ, reniformes, 2-valves (valva antica breviore), circa connectivum carnosum reniformem semi-annulares, rima hippocrepica hiantes, demum peltatim expansæ, et tunc disciformes, medio umbonatæ. *Discus* fere obsoletus, vix ultra ovarii basin extensus. *Ovarium* conico-oblongum, 3-loculare; *ovula* in loculis solitaria, erecta. *Stylus* erectus, calyce dimidio brevior. *Stigma* fere obsoletum, obtuse 3-punctatum. *Fructus* globosus, pro mole majusculus, baccatus; sarcocarpium spongioso-carnosum, demum siccum et crasso-coriaceum: nux sphærica, 3-sulcata, dura, lignea, crassa, indehiscens, 3-locularis, loculis monospermis. *Semen* erectum, ovatum, subcompressum, structura omnino illius *Colletiæ*.

Suffrutices *Chilenses dumosi,* ramis ramulisque *longissime virgatis, teretibus, erectis, fere aphyllis, inermibus,* nodis *distantibus*; stipulæ *oppositæ, parvulæ, squamiformes, gibbosæ, acutæ, fuscæ, linea transversali prominula utrinque connexæ*; folia *opposita, minuta, caducissima, spathulato-oblonga*; flores *albi, oppositi, hinc distantiores et utrinque solitarii in ramulis novellis enati, vel in gemmam squamosam axillarem capitato-agglomerati.*

1. *Retamilia obcordata,* Brongn. Ann. Sc. Nat. x. 364. tab. 14; —Colletia obcordata, *Vent. Hort. Cels.* tab. 92; *Poiret in Lam. Dict. Suppl.* ii. 311; — Colletia (Retanilla) obcordata, *DC. Prodr.* ii. 28; — Rhamnus Retamilla, *Domb. MSS.*;— suffruticosa, 3-pedalis, ramis ramulisque erectis, virgatis, flexibilibus, apice mucrone apiculatis, junioribus albo-tomentosis, demum glabris, nodis remotis, quasi articulatis propter stipulas 2 oppositas majusculas acutas adpressas demum patentes inter se nexas; ramulis rarius abortivis, brevibus, et tunc spiniformibus; foliis oppositis, raris, cito caducis, inferioribus obcordatis, in petiolum brevem cuneatis, superioribus spathulato-ovatis, pubescentibus, 3-nerviis, pallide viridibus; floribus plurimis, fere sessilibus, glomerato-fasciculatis, vel sæpe interrupte spicatis; calyce urceolato, fulvo, extus villosulo, intus imo puberulo, limbi laciniis 5, acutis, erectis; petalis 5, cucullatis, unguiculatis, laciniis fere æquilongis; staminibus reconditis, antheris apertis peltiformibus; ovario pubescente.—Chile. —*v. s. in herb. Mus. Paris* (Ventenat) ex specimine culto cum notula "Pérou" (sine dubio erronea).

I am not aware of the existence of any indigenous specimen;

nor is the exact place of its growth known. The species was established by Ventenat, who made his drawing above quoted from a plant raised from seeds brought home by Dombey, first cultivated by M. Cels, and afterwards in the Jardin des Plantes, where Poiret also saw it growing. The specimen now in the Paris herbarium, which I have seen, was contributed by Ventenat: his drawing well accords with it. It is described as a shrub having much the appearance of a *Spartium*, growing to the height of 3 feet. In the structure of its flower it quite agrees with that of the two following species, the characters of which are better known; the only negative feature attached to it is the account recorded by Ventenat of its fruit, which is said to be 3-coccous, and therefore at variance with the structure known to exist in the other species and in *Trevoa*; but as it is very improbable that the fruit ever ripened in Paris, and as in the immature state it was found to be trilocular, we may conclude that it was only assumed to be 3-coccous, like the other known species of *Colletia*, to which genus it was thought to belong. Ventenat, on the other hand, mentions its fleshy mesocarp, which becomes coriaceous in drying, as I have found it in *R. stricta.*

2. *Retamilia Ephedra,* Brongn. Ann. Sc. Nat. x. 365; Hook. Bot. Misc. i. 157; ibid. iii. 173; — Colletia Ephedra, *Vent.* (*non Bert.*) *Choix,* tab. 16; *Lodd. Bot. Cab.* pl. 1820;— Rhamnus Ephedra, *Domb. MSS.*; — suffruticosa, dumosa, ramulis imo spinosis, superne inermibus, valde strictis, virgatis, compresso-teretibus, forte striatis, cortice carnoso vestitis, junioribus albido-tomentosis, demum glabris; nodis distantibus, stipuliferis, stipulis oppositis, gibbo-squamiformibus, fuscis, acutis, utrinque linea transversali nexis; foliis nullis, aut caducissimis; floribus plurimis, in capitulum subglobosum sessile utrinque axillare aggregatis, aut paucioribus, in spicam brevissimam enatis; pedunculo brevissimo, calyce urceolato, roseo-albido, extus pubescente, tubo intus imo piloso, pilis longis patentibus, limbi laciniis 4, brevibus, erectis, petalis 4, niveis, oblongis, unguiculatis, cucullatis, erectis, staminibus totidem, vix æquilongis, ovario conico-oblongo, piloso, stylo brevi, crassiusculo, ad medium attingente; fructu globoso.—Chile.—*v. s. in herb. meo*; Chile (Ruiz & Pavon), sine loco designato;—*in herb. Mus. Paris* (specim. typicum, Dombey); "Pérou," potius Chile;—*in herb. Hook.*; in convallibus Andium Chilensium; Concepcion (Lay & Collie); Chile, sine loco (Cuming, 704).

This is a well-established species; its Ephedra-like branches are rather stout, equal in thickness throughout, of considerable length, and about a line in diameter, the nodes being about

1–1½ inch apart; occasionally a few spines (or stunted branchlets) are seen, which are nearly erect, deeply striated, with a callous, pungent apex, and are 1–1¼ inch long. A capitate inflorescence is seen in the opposite axils of each node of the virgate branches; it is about ½ inch in diameter, and consists of an aggregation of small flowers; the peduncles are extremely short; the calycine tube is 1 line long, its segments being ⅓ line in length, it is 1¼ line in diameter*.

3. *Retamilia stricta,* Hook. Arn. Bot. Misc. iii. 173;—Retanilla affinis, *Clos, in Gay, Chile,* ii. 26;—suffruticosa, sesquiorgyalis, ramosa, ramis e basi plurimis, assurgentibus, ramulis strictis, virgatis, rigidis, erectis, glabris, teretibus, striatulis, fere aphyllis, nodis remotis; foliis oppositis, parvulis, rarissimis, caducissimis, spathulato-oblongis, carnosis, pilosiusculis, lateribus canaliculatim reflexis, breviter petiolatis; stipulis axillaribus, gibboso-squamiformibus, fuscis, acutis, oppositis, et utrinque linea transversali nexis; ramulo florifero brevi, aphyllo, racemiformi, nodis crebris, floriferis, squamis oppositis munitis; floribus ibi oppositis, solitariis, et hinc quasi racemoso-spicatis; calyce late cylindrico, carnoso, roseo-albido, extus glabro, intus imo piloso, pilis patentibus, limbi laciniis 5, triangularibus, erectis, demum e basi caduco; petalis 5, laciniis æquilongis, ovatis, cucullatis, unguiculatis, erectis, niveis; staminibus totidem, petalis reconditis, demum inflexis; ovario oblongo, 3–4-sulcato, stylo incrassato, subulato, tereti, longitudine fere tubi, pilosissimo, pilis longis, albis, creberrimis, patentibus; stigmate 3–4-lobo, lobis obtusis, adpressis; fructu globoso, cortice coriaceo, crasso, disco substipitiformi suffulto; nuce conformi, durissimo, indehiscente, lignoso, 3-, rarius 4-loculari, seminibus nitentibus. — Chile. — *v. v.* ad Quintero (*Retama* et *Retamilla* incolarum).—*v. s. in herb. Hook.*; Valparaiso (Cuming, 402);—*in herb. Mus. Paris*; in Prov. Cauquenes (Gay), vernac. *Frutilla del Campo.*

This species, so far as my observation extends, does not grow in the immediate neighbourhood of Valparaiso, but at a distance of twenty or thirty miles from that port, near the coast, where the violent surf and the strong incessant trade-wind produce elevated flats of considerable extent, formed of loose drift-sand carried to some distance in-shore; and it was only in such situations that I met with this shrub, growing among other trees and bushes. It is distinguished by well-marked characters from the preceding species. It grows to a height of 8 or 10 feet, with a broom-like habit, having very long, straight, erect branches, more

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* This species is shown in Plate 39 D of this work.

woody than in the preceding species, and all terminating in an acute spine. The stemlets are more slender, less deeply striated, with the internodes about ¾ inch apart; out of these nodes, in the younger branches, short foliiferous sprouts make their appearance, and out of the nodes of the upper part of the principal (annotinous?) branches, are produced the opposite spicated racemes of flowers, which are nearly the length of the internodes, bearing about three or four pairs of opposite flowers. The leaves are 1–1½ line long, only ½ line broad, cuneate, upon a very short petiole, entire, fleshy, 3-nerved, slightly pubescent, and folded back upon themselves; the pedicels are ½ line long, bracteated at base; the tube of the calyx, including the segments, is 1½ line long, and 1 line in diameter; the flowers are of a rose-colour. The fruit is spherical, 8 lines in diameter*.

4. *Retamilia articulata*, n. sp.;—Colletia articulata, *Philippi, Linn.* xxviii. 679;—suffruticosa, glaberrima, ramis teretibus, lævibus, simpliciter intricatim spinosis, spinis longiusculis, ramulisque articulatim nodosis, creberrime granuloso-punctulatis, apice calloso-pungentibus; foliis in ramulis novellis parvulis, ovatis, utrinque acutis, integris, crassiusculis, eveniis, glaberrimis, caducissimis, petiolo canaliculato in sinum stipulæ 2-dentatæ affixo; stipulis oppositis, linea transversali nexis (nodis proinde quasi articulatis); floribus in articulationibus utrinque 2–4, fasciculatis, e tuberculo bracteato enatis, pedunculo flori æquilongo, calyce cylindrico, limbi laciniis 4, triangularibus, erectis; petalis 4, squamiformibus, acutis, laciniis dimidio brevioribus; staminibus totidem, filamentis incurvatis, brevissimis, antheris ovalibus, petalis 2-plo latioribus, rima hippocrepica hiantibus, peltatim affixis; stylo brevi, incluso; stigmate capitato-3-lobo.—In Andibus Chilensibus versus Chillan (lat. 36° S.).—*v. s. in herb. meo et Hook.* (Germain).

This plant has much the habit of the three preceding species, but its branches are not so virgate, and have much shorter internodes: the branches, almost bare of leaves and spines, are quite terete, perfectly smooth, the internodes being ½ to ¾ inch apart; the spines are 8 to 12 lines long, the floriferous branchlets are twice or three times that length, having the appearance of articulated spines, and are often again spinose. The stipules at the nodes are small, simple, and acute, and the line of their connexion gives an articulated appearance to the branches. Very young branchlets, bearing leaves and flowers, grow out of the upper nodes, and, from the proximity of the axils, they appear

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* A representation of this species, with analytical details, is given in Plate 39 E.

almost agglomerated: the leaves are very small, ovate, or oblong, fleshy, nerveless, and obsoletely toothed on their margin, tapering into a short petiole; they are 1½ line long, 1 line broad, in opposite pairs upon a slender nascent shoot about ¾ inch long. From the axils and the articulations of the spines a short sprout is seen, bearing a few leaves and two or four flowers, which are almost fasciculated; the pedicels are a full line long; the cylindrical tube of the calyx is 1½ line long, with four segments of a quarter their length; the petals are like small white scales, intermediate with the segments, and only a quarter of their length; the anthers are like those of the preceding species; the ovary and style are glabrous. The flowers are pale when dried, and are probably nearly of a white colour when fresh*.

7. Trevoa.

This genus, first proposed by me (in 1825), was afterwards described by Sir William Hooker (in 1830), in the 'Botanical Miscellany,' where it is confounded with *Talguenea*; he subsequently (in 1833) suppressed the genus, referring the plant on which it was founded to *Retamilia*, because of its indehiscent fruit. In *Trevoa*, however, we have a tree of very hard wood, spreading into numerous thick tortuous branches, and equally tortuous branchlets, which are very spiny, with an abundant foliage, offering a strong contrast to the bare Ephedra-like branches of *Retamilia*. In *Trevoa* the calyx is persistent, does not enlarge, but remains withered, entire, and membranaceous, at the base of its fleshy drupe; while in *Retamilia* the whole of the calyx falls away, leaving its short stipitate torus (or small adnate disk) to support a much larger globular fruit. The form of the calyx is also dissimilar in the two genera, and the petals are larger and more cucullate. In the species on which I founded the genus, the ovary is uniformly bilocular, producing a small 2-celled fruit, often by abortion 1-locular: another species, which Sir William Hooker had inferred to be identical with mine, has a 3-celled ovary, producing a larger 3-celled nut, which circumstance induced that distinguished botanist to merge the genus into *Retamilia*; but the characters above mentioned are sufficient to keep them distinct. There is, however, another distinguishing feature in the shape of the stipules, which in *Trevoa* are deeply bifid, forming a small fuscous linear kind of wing attached to each side of the petiole, of nearly equal length, by which they are attached to the stem; and the bases of the opposite petioles are connected on each side by a transverse line across the stem.

By other botanists *Trevoa* has been confounded with *Talguenea*;

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* This plant is shown in Plate 39 F.

but the differences here are yet more strongly marked: the latter has not only a distinct form of calyx, but it is quite dissimilar in the structure of its fruit, which is enclosed in the entire unchanged persistent calyx, and which consists of an evalvate indehiscent membranaceous pericarp that bursts by laceration, only to allow of the escape of the seeds. The name of the genus was derived from the vernacular appellation of the typical species, *Trévo* or *Trébu*. Its character is thus defined:—

TRÉVOA, nob.—*Calyx* petaloideus, tubulosus, tubo imo inflato, medio sæpe constricto, fauce paulo ampliore, intus præsertim versus basin villosissimo, pilis albidis retrorsis, limbi laciniis 4 vel 5, triangularibus, erectiusculis, intus carina calloque notatis, marcescens et persistens. *Petala* 4–5, rotundata, cucullata, unguiculata, laciniis calycinis breviora, erecta. *Stamina* 4–5, petalis inclusa, et cum eorum unguibus inter lacinias inserta; *filamenta* brevia, pilosa, imo complanata, subulata, apice repente inflexa; *antheræ* rotundatæ, cis *Retamiliæ* similes. *Discus* parvus, carnosus, ovario 3-plo latior, subconcavus, adnatus. *Ovarium* e medio disci superum, conico-oblongum, 2–3-sulcatum, hirsutissimum, 2–3-loculare. *Stylus* erectus, 3–4-gonus, angulis ciliatis, imo validiusculus et hirsutissimus. *Stigma* 2–3-lobum, lobis obtusis arcte adpressis, albidum. *Fructus* drupaceus, ovatus, subcompressus, calyce marcido imo suffultus, endocarpio indehiscente nucamentaceo, 2–3-loculare, vel abortu uniloculare. *Semen* in quoque loculo solitarium, erectum, compresso-ovatum, nitidissimum, structura omnino *Colletiæ*.

Arbusculæ *Chilenses frondosæ, ramosissimæ, spinosæ, trunci ligno duro,* ramis *oppositis,* ramulis *infra spinas foliiferis et floriferis,* spinis *oppositis*; folia *opposita, ovata, serrulata,* 3-*nervia, fere glabra*; flores *e ramulis junioribus enati, in axillis oppositis solitarii, vel* 2–3, *fasciculati, hinc foliis carentibus sæpe racemosi, aut axillis approximatis quasi spicati.*

1. *Trevoa trinervis,* nob. Trav. ii. 529;—T. trinervia, *Hook. Bot. Misc.* i. 159;—Retanilla trinervia, *Hook. in parte, ibid.* iii. 174;—Colletia Trebu, *Bert.*; *Colla, Mem. Torin.* 37. p. 53;—arbuscula sesquiorgyalis, ligno duro rubente, ramosa, ramulis compressis, foliosis, spinosis, junioribus inermibus foliiferis et floriferis sub spinis enatis; spinis viridibus, decussatim oppositis, compresso-subulatis, calloso-pungentibus, patentissimis; foliis oppositis, ovalibus, mucronulatis, imo in petiolum cuneatis, crenulato-dentatis, 3-nervibus, nervis pellucidis subparallelis, lateralibus versus marginem ramosis, et hinc in glandulas marginales excurrentibus, reticulato-venosis, glabriusculis, petiolo brevi, canaliculato, singulis e stipula fusca bifida ortis

floribus interdum quasi spicatis; pedunculo brevissimo, piloso; calyce extus superne subgloboso, albescente, imo inflato, viridi et piloso, limbi laciniis 4, erectiusculis; petalis 4, niveis, laciniis brevioribus; staminibus 4, inclusis; antheris reniformibus, flavis, connectivo albo; stylo ovarioque 2-loculari pilosissimis; fructu ovali, subcarnoso, calyce marcido fulto; nuce ovata, 2-loculari, sæpe abortu 1-loculari.—Chile.—*v. v.* ad Concon.—*v. s. in herb. Hook.* (Cuming, 732).

This tree is of frequent occurrence upon the hills throughout the province of Quillota, in which the port of Valparaiso is situated, and is, I believe, more generally distributed, at no great distance from the sea-coast, in the central provinces of Chile: sometimes it appears as a tall bush, but it grows ordinarily to the height of 8 or 10 feet, with widely-spreading branches. Its trunk, scarcely exceeding 4 or 6 inches in diameter, consists of hard red wood, which is much sought for, as it makes an excellent fuel; it is also greatly in request for building purposes. Its spreading, opposite, subulate, green spines, which decussate at the distance of half an inch apart, are from half an inch to an inch in length. A single leaf issues from its corresponding stipule, that springs from the base of each spine. The leaves ordinarily measure ¾ inch, sometimes an inch in length, and 3 or 4 lines in breadth, the petiole being 1 line long. Each floriferous branch usually originates from the expansion of a tubercle situated between the spine and the stipule, and is commonly from 1½ to 3 inches long, with several decussating pairs of leaves towards its base, at distinct intervals of 1 to 3 lines, at each of which points two or four flowers arise, the leaves gradually disappearing towards the ends of these branchlets, the axils then approximating by degrees, so that the flowers assume a spicate appearance; each flower is from 1½ to 2 lines long, on a peduncle less than a quarter of a line in length; the calyx is of a yellowish-white colour, is somewhat contracted in the middle, glabrous in the upper part, the inflated base and peduncle being of a greenish hue and pubescent; it is constantly 4-toothed on its border, all its parts being 4-merous, and the hooded petals snow-white. Its somewhat compressed oval drupe, enclosing a hard nut, is 2 lines long, and 1½ line in diameter; the nut is ligneous and indehiscent*. Cuming's specimen in Sir William Hooker's herbarium is not in seed. Germain's plant, distributed under the name of *Trevoa 3-nervia*, is *Notophæna foliosa.*

2. *Trevoa tenuis*, n. sp.;—Retanilla 3-nervia, *Hook. & Arn. in parte, Bot. Misc.* iii. 174;—arbuscula præcedentis simillima,

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* This plant, with analytical details, is shown in Plate 40 A.

sed omnino pilosior, spinosa, ramulis sub-4-gonis, tenuibus, compressiusculis, pallide viridibus, glaberrimis, junioribus sæpe spinosis, spinis longiusculis, decussatim oppositis, simplicibus; foliis oppositis, ovalibus, imo in petiolum brevem attenuatis, integris, aut crenulato-dentatis, 3-nervibus, margine glanduliferis, glabris, junioribus utrinque pilosulis, et pulvere resinoso flavicantibus; floribus binis in axillis oppositis, et in ramulis novellis, foliorum defectu, sæpe glomerato-spicatis; calyce colorato, late cylindrico, haud constricto, extus valde pubescente, intus imo piloso; limbi laciniis 5, brevibus, erectiusculis, cum petalis 5, æquilongis, niveis, cucullatis, alternis; staminibus totidem, petalis inclusis, et iis dimidio brevioribus; filamentis brevibus, in lineis totidem patenti-pilosis decurrentibus; stylo brevi ovarioque 3-loculari longe patenti-pilosis, stigmatibus 3, oblongis, obtusis, adpressis, glabris; drupa carnosula, præcedentis 4-plo majore, ovata, nuce dura, crassiter lignosa, 3-loculari.—Chile.—*v. s. in herb. Hook.*; Bustamante, in via ad Santiago, alt. 2000 ped. (Bridges, 435; Cuming, 641).

This species is unquestionably distinct from the preceding, though much resembling it in general aspect; it is, however, much more spinose, its branchlets are thinner and straighter, its spines longer and more slender, its leaves smaller and more caducous. The internodes are 1¼ inch apart, the spines 1¼–1½ inch long; those of the lateral spinose branchlets are about ¾ inch long; the floriferous branchlets are 1½ inch long, the axils being from 1 to 3 lines apart. The leaves are 3–5 lines long, and 2 lines broad, upon a petiole 1 line in length; its flowers are constantly 5-merous; its calyx, 2 lines long, is double the diameter of that of the former species, and is scarcely contracted in the middle; externally it is very pubescent, its ovary is always 3-locular (not 2-celled), and it produces a much larger fruit, which is two or three times the size of that of *T. trinervis*, being 4 or 5 lines long, and 3 or 4 lines in diameter: the ligneous walls of its 3-locular nut are thicker than in the foregoing species. In other respects both kinds are much alike. It appears to grow further away from the coast, upon the more elevated table-lands, and in the valleys of the interior*.

3. *Trevoa Berteroana.*—Retanilla spinifer, *Clos, in Gay, Chile*, ii. 27;—spinosa, ramulis rectis, tenuibus, striatulis, glabris, fusco-viridibus, sub spinis ortis; spinis oppositis, tenuibus, subulatis, calloso-acicularibus, paulo patentibus; foliis oppositis, vel sæpe in axillis utrinque binis, cuneato-ovatis, vel

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* This species is represented in Plate 40 B.

obcordatis, apice obtusis, retusis et mucronulatis, integris vel obsolete dentatis, 3-nerviis, utrinque sparsim puberulis, supra viridibus, subtus albido-pulverulentis, nervis rubescentibus, pellucidis; petiolo brevi canaliculato; stipulis distinctis, oppositis, patentibus, rubellis, obsolete 2-dentatis; floribus parvis, in axillis ramulorum 1 vel 2, pedunculo brevi, puberulo; calyce breviter tubuloso, extus imo puberulo, superne glabro, intus valde piloso, limbi laciniis 4, brevissimis, subpatentibus, petalis 4, laciniis æquilongis, orbicularibus, cucullatis, antheris iis inclusis; drupa sicca ovali, mole fructus *T. trinervis*, apice retrorsum albido-pilosa, imo calyce marcido fulta, nuce 1–3-loculari.—Chile, in montibus Prov. Rancagua et Colchagua.—*v. s. in herb. Mus. Paris.* Rancagua (Bertero, 193).

The plant described by Dr. Clos (Gay's specimen from the same locality), and referred by him to *Retamilia*, is evidently identical with the above species, which I have characterized from Bertero's collection. I do not adopt his specific name, as all the species of *Trevoa* are spinigerous *.

4. *Trevoa Weddelliana*, n. sp.; — suffruticosa, spinosa, ramosa, ramulis teretibus, brachiatis, breviter pubescentibus, pilis patentibus; spinis decussatim oppositis, subulatis, pungentibus, divergentibus, sæpe foliosis; ramulis junioribus foliiferis et floriferis, sæpe inermibus; foliis oppositis, ovatis, integris, parvulis, vernatione complicatis, læte viridibus, subtus pallidioribus, utrinque parce pubescentibus, nervis paucis superne immersis, inferne vix prominulis, inter se arcuatim nexis et rubellis; stipulis utrinque profunde bifidis, laciniis anguste linearibus, imo petioli adnatis, rubellis, pilosulis; floribus 2–3 folio æquilongis, pedunculo imo bracteolato, calycis tubo urceolato, imo subgloboso, puberulo, limbi laciniis 5, reflexis, tubi tertia parte longitudinis, apice intus callo carinaque mediana notatis, carinis pilosulis ad basin tubi decurrentibus; petalis 5, obovatis, cucullatis, imo unguiculatis, laciniis æquantibus, erectis; staminibus iis reconditis; disco poculiformi, omnino adnato; ovario subglabro; stylo erecto, piloso, faucem tubi attingente; stigmate 3-lobo.—Bolivia, circa Chuquisaca.—*v. s. in herb. Mus. Paris* (Weddell, 1212).

This plant greatly resembles *T. trinervis* in habit, but it has much smaller leaves, and is altogether more spinose. The internodes are 8–9 lines apart; the spreading, decussating spines are about the same length; the foliiferous branchlets are from ½ inch to 2½ inches long, bearing about two flowers in the lower

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* A figure of this plant is given in this work, Plate 40 c.

axils; the leaves are 3 lines long and 1½ line broad, on a petiole of 1 line in length; the peduncle is 1½ line long, the tube of the calyx 1¼ line long, retrorsely puberulous; the segments are ¾ line in length; the nervures within the calyx are retrorsely pilose, as in *T. trinervis*; the ovary and style are nearly glabrous, and included *.

5. *Trevoa Closiana.* Colletia tetrandra, *Clos, in Gay, Chile,* ii. 31;—fruticosa, 2-pedalis, dumosa, ramis subaphyllis, intricato-curvatis, fusco-nigricantibus, rigide spinosis, spinis decussatim oppositis, subulatis, crassiusculis, simplicibus; foliis minimis, caducissimis, lineari-oblongis, crassis, 3-nerviis, fere integris, margine obsolete crenato, superne obscure viridibus, lucidis, sparsim pilosis, subtus flavido-pallidis et dense pilosis, breviter petiolatis; stipulis majusculis, squamiformibus, imo subamplexicaulibus, valde concavis, rubris, glabris, intus parce tomentosis, 2-dentatis; floribus paucis, e gemma ad basin spinarum versus extremitatem ramorum enatis; pedunculo brevissimo, albo-tomentoso, calyce urceolato, imo extus cinereo-piloso, limbi laciniis 4, erectis; petalis 4, oblongis, valde cucullatis, unguiculatis, laciniis æquilongis, erectis, imo subcoloratis et puberulis; staminibus totidem, iis reconditis, demum inflexis; ovario niveo-piloso, sub-3-lobo; stylo brevi, tereti, pilosulo; stigmate obsolete 3-lobo.—Chile.—*v. s. in herb. Mus. Paris*; Coquimbo, in via ad Arqueros (Gay, 264).

Dr. Clos, on the authority of M. Gay, describes this as a low-growing shrub, about 2 feet high, with intricately twisted branches, which are armed with numerous simple spines, half an inch in length, and a similar distance apart. They are often leafless; the extremely deciduous leaves are very small, almost entire, or crenulated on their margin; they are linear-oblong, and 1 to 3 lines in length. The small white flowers, which become dark in drying, are 4-merous, and scarcely exceed a line in length (including their very short peduncle), and half a line in diameter. The stamens are hidden within the short cucullate petals, the anthers, after dehiscence, becoming peltate, as in the other species of the genus. It is known by its vernacular name of *Abrojo*, which in Spanish signifies a bramble. These characters are all quite in accordance with those of *Trevoa*†.

8. TALGUENEA.

The characters of this genus are imperfectly known, but they are sufficiently distinct from all others of the *Colletieæ*, especially from *Trevoa*, with which it has been confounded. It was originally proposed by me, in 1825, for the plant which I called *Talguenea costata*, after its vernacular name of *Talguén*; but Sir Wm. Hooker, in 1830, who had not then seen the fruit of *Trevoa*, considered it to be congeneric with the latter genus; and, on the authority of Dr. Gillies, he suppressed *Talguenea*, and placed the two typical plants as distinct species of *Trevoa* (Bot. Misc. i. 158). The former celebrated botanist, in 1833, having then seen the fruit of *Trevoa*, was induced to suppress that genus, and to refer *T. trinervis* to *Retamilia*; and at the same time (Bot. Misc. iii. 174) he first adopted the genus *Talguenea* as I had originally proposed it. It is strange that Dr. Gillies should have confounded two plants so totally distinct, as not only had he ample opportunity, while he resided with me at Concon, of examining them in the living state, but he also saw my drawings, in which their characters are fully shown. Colla, claiming the authority of Bertero, referred both *Talguenea* and *Trevoa* to *Colletia* (Mem. Torin. 37. p. 53). The prominent characteristic of *Talguenea* lies in the structure of its fruit, which consists of an indehiscent membranaceous carcerule, surmounted by its enlarged persistent style, of nearly equal length, and enclosed in its entire and unchanged calyx, which is perfectly free from it, and about three-quarters of its length. The ovary is always 3-locular, each cell having a single erect ovule, but of these seldom more than one is perfected; the fruit, however, is occasionally 2-locular, or more rarely 3-celled. Among other peculiarities, we see in all the axils of *Talguenea* a very large squamose tubercle growing beneath the spines, from which issue many crowded fasciculated leaves and flowers; whereas in *Trevoa*, as before shown, this tubercle becomes extended into an elongated branchlet, on which the leaves are distributed in pairs, by distinct intervals, and towards the extremity become abortive, when the flowers assume a spicated or racemose appearance. I have defined its generic features in the following manner:—

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* This species is represented in Plate 40 D.

† A figure of this plant is given in Plate 41 A.

Talguenea, nob. — *Calyx* petaloideus, turbinato-tubulosus, membranaceus, 10-nervis, fere ad medium 5-fidus, laciniis oblongis, acutis, 3-nervatis, apice callosis, æstivatione valvatis, demum reflexis, tubo intus piloso, persistens, immutatus et marcescens. *Petala* 5, erecta, laciniis æquilonga et alterna, rotundato-oblonga, concava, subcucullata, unguiculata. *Stamina* 5, petalis inclusa et cum unguibus inserta; *filamenta* tenuia, pilosa, complanata, medio carinata, margine membranacea et ciliata, apice repente inflexa; *antheræ* parvæ, reni-

formi-rotundatæ, 2-lobæ, lobis 2-valvatis, valvula antica breviore, et hinc rima hippocrepica latissime hiantes. *Discus* fere obsoletus, calyci adnatus, ovarium fulciens et ejus diametrum vix excedens, cum toro confusus. *Ovarium* superum, disco paululo immersum, 3-loculare; *ovula* erecta, in loculis solitaria. *Stylus* filiformis, longe exsertus, ultra medium patentim hirsutissimus, superne glaber, profunde 3-sulcatus. *Stigma* breviter 3-lobum, lobis obtusis, adpressis, glutinosis. *Fructus* carcerularis, chartaceus, valde hirsutus, oblongus, calyce immutato inclusus, eo paulo longior, stylo persistente terminatus, indehiscens, 3-locularis, sæpius abortu 2- vel 1-locularis, loculis monospermis. *Semen* ovatum, lenticulari-compressum, structura omnino ejus *Colletiæ*.

Arbusculæ *Chilenses valde ramosæ*, ramulis *confertis, tortuosis, decussatim divaricatis et oppositis, junioribus brevibus et spinosis*; folia *integra, oblonga, in petiolum brevem cuneata, sub-5-nervia, nervis parallelis costata, supra glauca, infra albido-sericea, e tuberculo majusculo infra spinam egrediente cum floribus glomeratim congesta*; flores *fasciculati, albescentes.*

1. *Talguenea costata*, nob., Trav. ii. 529; Hook. Bot. Misc. iii. 174;—Trevoa 5-nervia, *Gill. et Hook.* ibid. i. 158, tab. 45 B.;—Colletia Tralhuen, *Bert. Colla, Mem. Torin.* 37. p. 53, tab. 7;—arbuscula orgyalis, ligno duro rubro, tortuose ramosissima, ramulis fuscis, cinereo-tomentosis, spinosis, spinis decussatim oppositis, validiusculis, subulatis, folio subbrevioribus; foliis oppositis, vel e gemma squamosa sub singula spina enata plurimis aggregatis, oblongis, mucronatis, basi cuneatis, supra glauco-viridibus, parce pubescentibus, subtus pilis adpressis incanis sericeis, nervosis, nervis 5–7 subparallelis superne immersis, et hinc profunde sulcatis, subtus nervis costato-prominentibus, petiolo breviusculo, sericeo; stipulis squamosis, acutis, fusco-rubris, sericeis, ciliatis, linea transversali connexis; floribus 4–6, vel plurimis, in singulam gemmam conglomeratis, pedunculo calycis longitudine, tomentoso, tubo calycino turbinato, extus pubescente, intus præsertim infra stamina piloso, limbi laciniis 5, acutis, reflexis, tubo brevioribus; petalis 5, niveis; staminibus reconditis; ovario piloso; fructu calyce marcido incluso et eo paulo longiore, stylo piloso, acuminato.—Chile, in Prov. centralibus.—*v. v.* prope Limache, Concon, Quillota, et aliis locis.—*v. s. in herb. Mus. Paris.* (Gay); *in herb. Hook.* (Cuming, 713; Bridges, 433); *ibid.* (Banda oriental. ?, Tweedie). Vernac. *Talguén.*

The trunk of the Talguén, on account of its hardness, is useful for turning-purposes; but it is mostly employed in Chile as

fuel in the mining localities, for which it is admirably adapted, and is much sought for about the copper-works of Quillota, Illapel, and Petorca. In some places the trunk grows to a considerable size, and is preferred, on account of its indestructibility when sunk in the ground, for the construction of the cottages and ranchos of the country. Its spines are spreading, ½ inch long, their acute tips being reddish; the leaves are 6–9 lines long, 2–3 lines broad, on very short reflected petioles; the peduncles are nearly 2 lines long; the tube of the calyx is of the same length, and the lobes of its border are 1 line long. The carcerule is a thin indehiscent chartaceous shell, 2½ lines long, 2 lines in diameter, enclosed by the free and somewhat extended calyx, and is surmounted by the hirsute persistent style, which is equal to it in length: it is rarely 2-locular, generally by abortion only 1-celled, in which case the axis with the abortive cells form a prominent ridge that runs down one side of the shell, and leaves a corresponding impression on the enclosed seed. The seed is polished, of a dull brown colour, oval, and somewhat compressed*.

In Sir Wm. Hooker's herbarium I find a specimen, as above mentioned, stated to have been found in the woods of the Uruguay, with a ticket in Tweedie's handwriting; but I suspect that the ticket belongs to another specimen, which by mistake has been changed, and that the plant came originally from Chile, for I perceive no difference whatever between that specimen and others collected in the latter country. It can hardly be imagined that the same species of a genus so peculiarly Chilean should be found at a distance of 1500 miles, in a different soil and climate, with the lofty Cordillera of the Andes intervening, without the least indication of its existence in any intermediate place. As I have met with other accidental, though rare, instances, in that extensive herbarium, of a similar interchange of tickets, I entertain the greatest doubt of the correctness of the locality in question, for the reasons stated.

2. *Talguenea mollis*, n. sp.;—fruticosa, spinosa, ramis ramulisque rectis, teretibus, griseo-tomentosis, spinis foliis triplo brevioribus, foliiferis, tenuibus, aciculatis; foliis submembranaceis, ellipticis, utrinque acutis, subdenticulatis, superne fusco-viridibus, subtus canescentibus, utrinque sericeis, 5-nerviis, nervis supra immersis, subtus vix prominulis, petiolo brevi; stipulis majusculis, oppositis, navicularibus, subamplexicaulibus, extus griseo-sericeis, intus rubro-pilosis, apice 2-dentatis; inflorescentia in racemis brevibus oppositis multiflora, floribus in fasciculis 6–8, approximatis, fasciculis 6–8-floris, idcirco 30–

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* A drawing of this plant, with analytical details, is given in Plate 41 B.

60 in racemo, hinc crebriter conglomeratis, pedicellis flore longioribus, cano-sericeis.—Chile, in Prov. Rancagua.—*v. s. in herb. Mus. Paris.* (Bertero, 188).

This species has a different aspect from the former: the branchlets are quite straight and sericeous, and the spines much thinner, not exceeding 4 lines in length, and foliiferous in the middle. Its leaves are much thinner in texture, neither sulcated above, nor costately nerved beneath, the nervures being very fine, and scarcely prominent; they are remotely denticulated with extremely short teeth, sericeous on both sides, silvery below, 9–10 lines long, 4½ lines broad, on a petiole 1½ line long; the stipules are comparatively large, concave, opposite, and meeting each other in the middle of the stem, which they thus completely embrace; they are deeply bifid, 1½ line long, externally sericeous, internally and on the margin red. The racemose branchlets are 1 inch long, and bear from forty to sixty flowers, crowded in the manner above specified*.

9. SCYPHARIA.

Under this head are brought together a few spinose shrubs, or small trees, more or less foliaceous in habit, distinguished by their opposite leaves; small flowers, with an urceolate 5-fid calyx; small, deeply emarginate, naviculate petals, enclosing as many stamens; and a 2-celled ovary: they are very different from *Trevoa,* to which they approach the nearest in their floral structure. The fruit of most of them is unknown; but Kunth describes that of his *Rhamnus Guayaquilensis* as being an oval drupe, somewhat fleshy, smooth, and bilocular, or by abortion 1-celled, as in *Trevoa.* The manuscript characters contributed by Bonpland are not to be relied on, as Kunth found them disproved by the analysis he made of the dried specimens; the latter may therefore be accepted as the more correct. They correspond thus with the general features of the *Colletieæ,* and the species here associated harmonize sufficiently together. Kunth describes the nut as containing two hard and crustaceous pyrenæ, one of which he found abortive, the other emptied by caries: this coating evidently corresponds with the hard crustaceous covering of the seed common to all the *Colletieæ.* The genus, therefore, in the absence of perfect specimens, can only be characterized imperfectly, and its features will no doubt require some modifications whenever better evidence can be obtained; but in the mean while, the facts already established tend to confirm its validity. Its name is derived from *σκύφος, scyphus,* in allusion to its cup-shaped disk, after the example of

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* This species is represented in Plate 41 c.

Discaria, to which genus one of the species has been referred by Dr. Hooker, on account of its disk.

SCYPHARIA, nov. gen.— *Calyx* campanulatus, semiglobosus, coloratus, glaber, limbo 5–6-fido, laciniis ovatis, acutis, æqualibus, immutatus et persistens. *Petala* 5, interdum 6, parva, inter lacinias alterna, iisdem dimidio breviora, subreniformia, apice plus minusve profunde emarginata, aut bifida, basi unguiculata, lateribus inter se mutuo plicata, et stamina claudentia, glabra, alba. *Stamina* tot quot petala, et cum eorum unguibus inserta; *filamenta* subulata, glabra; *antheræ* ellipticæ, 2-loculares, utrinque rima longitudinali dehiscentes. *Discus* cupuliformis, calycis tubo brevior, et ei omnino adnatus, carnosus, flavescens. *Ovarium* superum, globosum, fundo disci insitum, glabrum, 2-lobum, 2- (vel 3-?) loculare; *ovula* erecta, in loculis solitaria. *Stylus* teres, crassus, brevis, glaber. *Stigma* 2-lobum, lobis obtusis, conniventibus. *Fructus* drupaceus, ovatus, imo calyce persistente suffultus, 2-locularis, loculis monospermis, vel abortu 1-locularis. *Semen* crustaceum; cætera ignota.

Suffrutices *Ecuadorenses et Gallapagenses, interdum spinosi*; spinæ *decussatim oppositæ, divaricatæ*; folia *oblonga, sæpius glaberrima, petiolata, cito caduca*; flores *pauci, minimi, fasciculati, axillares vel sub spinis propullantes.*

1. *Scypharia Guayaquilensis*;—Rhamnus Guayaquilensis, *H.B.K.* vii. 55;—Rhamnus decussatus, *R. & P. in herb. Lambert.*;—Sageretia Guayaquilensis, *Brongn. Ann. Sc. Nat.* x. 360;—fruticosa, suborgyalis, ramosissima, subspinosa, ramis ramulisque angulato-tetragonis, lævibus, glabris; spinis elongatis decussatim oppositis, sparsis, patentibus, glabris, apice pungentibus, axillis foliiferis pluribus munitis et post casum foliorum nodosis; foliis oppositis, parvis, obcordatis, apicem versus rotundatis, profunde retusis et mucronatis, è medio in petiolum brevem cuneatis, integerrimis, crassis, nervis immersis, utrinque glabris et pallidis, caducis; floribus sparsis, viridibus, 5-meris; petalis bilobis, squamæformibus, filamentis brevissimis; ovario glabro, 2- (vel 3-?) loculari; fructu obovato-rotundo, compressiusculo, calyce parvo suffulto, lævi, parce carnoso, 2-loculari, loculo abortivo sæpe uniloculari.—Ecuador ad Guayaquil.—*v. s. in herb. Mus. Paris.* (Bonpland).

I have examined the original specimen of this plant, described by Kunth, which is in a very unsatisfactory condition: the two loose leaves that accompany it certainly do not belong to it, as that able botanist suspected. Bonpland related, in his notes, that they were alternate; but the cicatrices on the branches show

them to have been opposite, which is confirmed by the specific name given to it by the authors of the 'Flora Peruviana,' indicating that both the leaves and spinescent branchlets are decussately opposite. The axils of the secondary branchlets are about ½ inch apart; those of the tertiary branchlets or ramiform spines, which are 1½ to 2 inches in length, are about 4 lines apart, these branchlets being quite square, with prominent decurrent angles. The loose leaves described by Kunth, with their short petiole, are 1½ inch long and 10 lines broad, and evidently belong to some other plant. I found a few of the real leaves still remaining; they are very small, being only 3 lines long and 3 lines broad, on a petiole ¼ line in length: these, on account of their minuteness, had been overlooked by that botanist. The flowers are small, and almost sessile. Kunth was correct in his opinion that this species and his *Rhamnus senticosa* are congeneric, and that neither of them really belong to *Rhamnus**.

2. *Scypharia parviflora*;—Discaria parviflora, *Hook. fil. Linn. Trans.* xx. 229;—suffruticosa, intricata, ramis ramulisque strictis, tetragonis, compressis, subaphyllis, crebre spinescentibus; spinis decussatim oppositis, longissimis, horizontaliter patentibus, striatulis, calloso-pungentibus, internodiis spinis 5-plo brevioribus; foliis oppositis, oblongo-obovatis oblongisve, utrinque obtusis, apice mucronulatis, integerrimis, caducis, opacis, supra viridibus, subtus cuticula resinoso-crustacea glaucis, glabris, pinnato-nervosis, nervibus omnino immersis, petiolo brevissimo, subtereti, superne canaliculato; floribus sparsis, minutis, solitariis binisve, subsessilibus, 5-meris; petalis 2-fidis, latissime spathulatis, ungue brevi; ovario 2-loculari.—Ins. Gallapagos.—*v. s. in herb. Hook.*; Albemarle Island (Darwin).

This plant appears to correspond well in its characters with the preceding and the following species: it grows abundantly, forming thickets near the sea. Its branchlets are slender and very glabrous; the spines are from 12 to 20 lines long, and the internodes 4 lines apart; the leaves are nearly 1 inch long, and 4 lines broad, on a petiole 1 line in length. It is worthy of remark, as indicative of the limit of the genus, that many of the plants of the Gallapagos are identical with those of Guayaquil, which is in the same latitude, and the nearest opposite point of the continental coast †.

3. *Scypharia senticosa*;—Rhamnus senticosa, *H. B. K.* vii. 54;—Sageretia senticosa, *Brongn. Ann. Sc. Nat.* x. 360;—Colletia spicata, *Willd. in R. & Sch.* v. 513;—fruticosa, orgyalis, ramosissima, spinosissima, glaberrima, subaphylla, ramis sub-

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* A representation of this species is given in Plate 42 A.

† This species is represented in Plate 42 B.

oppositis, ramulis teretibus, spinis decussatim oppositis, longissimis, subulatis, teretibus, patentissimis; foliis paucis, ad basin spinarum solitariis, ovatis, basi rotundatis, integerrimis sub-5-plinervibus, subcoriaceis, glaberrimis, glauco-viridibus, deciduis, petiolo brevi, supra canaliculato, glabro, basi articulato; floribus 5-meris, minutis, 5–6, sub basi spinarum fasciculato-glomeratis, sessilibus, viridibus, bracteolatis; fructu baccato, globoso, abortu 1-spermo; semine lenticulari.—Vern. *Molono* incolarum.—Peruvia alta, Prov. Truxillo ad Contumasay.—*v. s. in herb. Mus. Paris.*, Zarzal (Bonpland, 3720).

There is a great approximation of characters between this and the two preceding species, and more especially with the latter, the principal difference consisting in its ovary, which is represented as being 3-locular,—a difference which it must be remembered exists also in *Trevoa*. Contumasay, where it is found, is scarcely 4° south of Guayaquil. Its branchlets are glaucous, and obsoletely pubescent, as well as sub-4-gonous; its spines are horizontal and opposite, sometimes a little alternate, and from 10 to 20 lines long; its leaves are said to be not quite an inch long, on a petiole 1 line in length, but they are now wanting in the specimen. Kunth observes that the leaves are very deciduous, and that the specimen he examined was almost aphyllous, looking quite like a *Colletia*; the same may be said of *S. pauciflora*. The floriferous branchlets are about the length of the spines, spring from below them, and are more slender and flexible: the flowers (1 or 2) are sessile in the opposite axils of the nodes, which are about a line apart; they are very minute, scarcely more than a half-line in length and the same in diameter*.

Species dubiæ.

4. *Scypharia tetragona*;—Colletia tetragona, *Brongn. Ann. Sc. Nat.* x. 366;—ramosa, ramis ramulisque elongatis, virgatis, patentibus, tetragonis, angulis prominulis, spinosis, glaberrimis, nodis remotis sæpius aphyllis, spinis validis, subulatis, valde divaricatis, apice calloso-pungentibus; stipulis rudimentariis, calloso prominentibus, apice (e petioli delapsi articulatione) cicatricosis, sub spinis ortis, foliis deficientibus; racemis aphyllis, spina longioribus, inter stipulas et spinas enatis, tetragonis, sub-6-floris; floribus decussatim oppositis, pedicellis brevissimis, imo articulatis, calyce persistente, breviter campanulato, membranaceo, 15-striato, margine breviter 5-lobo, lobis obtusis, mucronulatis.—" Peruvia." —*v. s. in herb. Mus. Paris.* (Dombey).

I have seen the above-named original specimen, which has neither flower nor fruit; but its racemes remain, showing a few of its persistent calyces. After examining it attentively, I have come to the conclusion that it is not a *Colletia,* though probably belonging to the same tribe. Attached to the sheet in which it is enclosed is a small cartouch, containing some loose drupes, and labelled "Volkameria calva." These drupes are without any calyx, are fleshy, dark-coloured, apiculated by the base of the style, and 5 lines in diameter; they contain each two nuts, which quite correspond with the structure of that genus. We may therefore inquire, do these drupes belong to the specimen in question? It appears to me they do not; for if they had been there when Brongniart described his "*Colletia tetragona,*" he would not have failed to notice so manifest a clue to the affinity of the plant. It is therefore most probable that these seeds have been since placed there by mistake. This conclusion is confirmed by an examination of the specimen. In *Volkameria* and other Verbenaceous plants of the same tribe, the occasional presence of spines is owing to the growth of the petioles of abortive leaves; and we invariably find in all such cases both the inflorescence and young branchlet sprouting out from above such spine. But in the specimen in question, as in all the *Colletieæ,* the spine is not produced from a petiole: it is superior not only to the floriferous branch, but also to the peculiar process which served as a support to the fallen leaf; for that calloid process shows a scar upon its extremity, indicating the articulation of the petiole upon it, similar to the same structure seen in *Scypharia Guayaquilensis,* only that in the former case the lateral teeth are not developed: the floriferous branch, as in the *Colletieæ,* rises from between that process and the spine, and is quite analogous to the racemose twig of the species last mentioned; it has a similar 4-angled stem, with salient angles, and the flowers in both cases are nearly sessile, and placed at some distance in decussate pairs. In this specimen of "*Colletia tetragona,*" although the fruit has fallen away, the persistent calyx is of a somewhat campanulate form, with five short rounded lobes, and within, at its base, is the vestige of an apparently small disk, with a free border, showing in the middle the scar where the fruit was attached. There is another consideration: in *Volkameria spinosa,* and other species of that genus, the inflorescence is a cyme, 3-chotomously branched, the flowers being borne upon long slender pedicels, bracteated at their base; but in this plant the flowers are arranged in almost sessile pairs upon a straight rachis. These circumstances induce me to retain the plant among the *Colletieæ,* where Brongniart first placed it, and to arrange it provisionally in *Scypharia,* with which it offers so many points of analogy, until a better knowledge can be obtained concerning it. I may also add that its spines conform exactly to those of the *Colletieæ,* having the same corneous pungent apex*.

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* A drawing of this species is given in Plate 42 c.

Observations.—The *Rhamnus microphyllus,* H.B.K. tab. 616, from Mexico, might be thought to belong to *Scypharia,* on account of its 2-lobed petals and 2-celled ovary; but its habit is quite incompatible. Its branches are spineless, decumbent, and alternate; its leaves also are alternate. Its relation is probably with *Microrhamnus ericifolia,* A. Gray (Pl. Wright. p. 34), to which perhaps *Colletia disperma,* DC., is allied, all being indigenous to Mexico.

A new genus has lately been proposed in the 'Linnæa' (xxviii. 618), by Dr. Philippi, under the name of *Sciadophila,* founded upon the *Colletia Maytenoides* of Dr. Grisebach, a plant from one of the southern provinces of Chile (Valdivia). I have carefully examined this plant, and find that in its general habit and in its floral structure it differs in no respect from the genus *Condalia* of Cavanilles. Dr. Philippi places his genus among the *Colletieæ;* but it evidently belongs to the *Rhamneæ* (*Frangulineæ,* Reiss.): the segments of the calyx are divided to the margin of the disk, and are deciduous, as in *Condalia,* it has also no petals; the stamens are of the same form, and are similarly situated; in the structure of its ovary, in its style and stigma, it likewise agrees; and the fruit is also a berry, seated on the persistent cupular base of the calyx. In its general habit it quite resembles other species of *Condalia,* its leaves being alternate, and it has no spines. Dr. Philippi describes its flowers as being pentamerous; but in the specimen I examined they were certainly tetramerous, as in the other species of the genus. I do not doubt the accuracy of the former statement; for it is very probable that its flowers may occasionally be abnormally pentamerous. I add below, in a note, my observations upon the above-mentioned plant†.

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* This plant is figured in Plate 42 D.

† *Condalia Maytenoides;*—Sciadophila Maytenoides, *Phil. Linn.* xxviii. 618;—Colletia Maytenoides, *Griseb. loc. cit.* p. 619;—frutex vix orgyalis, inermis, ramulis gracilibus, striatis, subglabris, valde foliosis; foliis alternis, elliptico- vel lanceolato-oblongis, utrinque acutis, integris, margine cartilagineo, subrevoluto vel interdum obsolete crenulato, glaberrimis, subtus paulo pallidioribus, crassiusculis, nervis superne omnino immersis, subtus vix prominulis, rachi superne sulcato, infra prominente; petiolo brevi, pallido, canaliculato; stipulis parvis, caducissimis; floribus axillaribus, solitariis, vel binis, glaberrimis, calycis tubo urceolato, brevi, limbo 4-fido, æquilongo; staminibus 4, laciniis dimidio brevioribus, erectis, antheris parvis, globosis, apicifixis; ovario glabro; stylo staminibus æquilongo, glabro, crassiusculo, subulato; stigmate 3-dentato. Bacca (sec. Phil.) nigra, basi angustata, insipida.—Chile, in nemoribus Prov. Valdiviæ.—*v. s. in hb. Mus. Paris.* (Philippi).

ERRATA AND MEMORANDA.

Page 77.—Since the text here referred to was published, I have detected, within the mesocarp of a unilocular drupe of *Pennantia Cunninghami*, two very distinct threads or tubes, running from its base to its apex, which are evidently the remains of two abortive cells, thus proving the truth of the inference stated in the text (p. 75). I have represented the fact, as I observed it, in Plate 12. fig. 17, where the dorsal position of the raphe is shown, in relation to those abortive cells and to the original axis of the ovary.

Page 95.—adde, 23. *Stemonurus apicalis,* nob. Linn. Trans. xxii. 110. Urandra apicalis, *Thw. Hook. Journ. Bot.* vii. 211; *Enum. Pl. Zeyl.* 43.—Ceylon.

Page 98.—in *Platea Wightiana,*—pro tab. 933, lege 953.

Mr. Thwaites (Enum. Pl. Zeyl. 43) states that at first he had agreed with me, but afterwards was convinced I was in error in referring the genus *Gomphandra,* Wall., to *Stemonurus,* Bl.: he now considers the former to be identical with *Platea,* Bl. The diagnoses of those genera, as given by me in pp. 85 and 96, were based on my own observations; and it will be seen how nearly they agree with their characters as published by Blume (Mus. Lugd. Bat. i. 249).. The main distinguishing feature between them is the well-marked dissimilarity of their stamens: in *Platea* the filaments are more compressed and quite glabrous; in *Stemonurus* they are as long as the petals, often growing longer, very fleshy, and invariably tufted at the apex with numerous long divaricating clavate hairs; and this very conspicuous feature I found constant, both in the male and female plants of every species of *Gomphandra* I was able to examine. I therefore consider I was correct in referring Wallich's plants of *Gomphandra* to *Stemonurus*: the only exception was in the instance figured by Dr. Wight (Icon. 953) as a male plant of *Gomphandra polymorpha,* which on account of its glabrous stamens I referred to *Platea,* under the name of *P. Wightiana,* nob., as above mentioned. Having had only a solitary fruit of *Stemonurus Gardneri* to examine, it is evident, from the withered growth of the embryo, that I mistook for cotyledons the plate of compact tissue which fills the singularly large compressed vacuity that nearly separates the albumen into two parts, as it is well described by Mr. Thwaites, whose account, derived from the examination of living specimens, must be taken as a more accurate description of the albumen and embryo in the seed of *Stemonurus.* I have represented in my drawing, Plate 13 B. figs. 16 to 19, the facts and the state of growth as they existed in the solitary instance I was able to examine. The more or less fibrous structure of the putamen appears, in Mr. Thwaites's opinion, the distinguishing feature between the latter genus and *Platea*; but this character, so likely to vary in different individuals, certainly is not so valid a distinction as the remarkable difference in the structure of the stamens, above mentioned.

Page 279.—insert *Discaria articulata,* with its diagnosis, which by mistake has been described in p. 289, under the name of *Retamilia articulata.*

Page 284.—after "Ceanothus infestus, *H.B.K.*" erase "ii. 31.", and insert "vii. 61. tab. 614; *DC. Prodr.* ii. 31. Colletia multiflora, *Moç. et Sess. in DC. Prodr.* ii. 29."

Page 289.—expunge *Retamilia articulata,* and transfer the entire character to p. 279, under the name of *Discaria articulata,* nob.

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DESCRIPTION OF THE PLATES

IN VOLUME I.

Plate 1.—Aptandra Spruceana.

Fig. 1, flower in bud. *Fig.* 2, the same expanded. *Fig.* 3, the same more advanced, with the corolla fallen away and the calyx beginning to increase in size: *all nat. size.* *Fig.* 4, a flower in bud. *Fig.* 5, the same expanded, the anther-cells not yet opened. *Fig.* 6, the calyx. *Fig.* 7, a petal. *Fig.* 8, the staminiferous tube invested by four fleshy glands at base, with the anther-cells at its summit after dehiscence. *Fig.* 9, a longitudinal section of the same. *Fig.* 10, the four free hypogynous glands: *all magnified.* *Fig.* 11, grains of pollen, *highly magnified.* *Fig.* 12, the pistil. *Fig.* 13, the same seen sideways: *both magnified.* *Fig.* 14, the stigma and part of the style. *Fig.* 15, vertical section of the ovary, showing two ovules suspended from a free central placenta. *Fig.* 16, the ovules with their strap-shaped funicle: *all more magnified.* *Fig.* 17, the calyx much grown. *Fig.* 18, the same, showing the growing ovary surmounted by the persistent stamens: *both nat. size.* *Fig.* 19, summit of the ovary, showing persistent style and staminal tube, *magnified.* *Fig.* 20, the ripe fruit invested by the persistent augmented calyx. *Fig.* 21, the calyx removed. *Fig.* 22, the drupe removed from the calyx. *Fig.* 23, vertical section of the unilocular chartaceous drupe, with the seed affixed by its placentary attachment to the base of the cell: the albumen is withered by drying. *Fig.* 24, a cotyledon extracted from the albumen: *all nat. size.* *Fig.* 25, the cotyledon, *magnified.* *Fig.* 26, the entire embryo, seen in front and sideways, *also magnified.*

Plate 2.—Cathedra.

A. Cathedra rubricaulis. *Fig.* 1, a flower in bud. *Fig.* 2, the same expanded: *both nat. size.* *Fig.* 3, one of the petals with an opposite stamen affixed to its base, seen from within. *Fig.* 4, the same viewed sideways. *Fig.* 5, the petal, with the stamen removed, showing the internal tuft of hairs. *Fig.* 6, transverse section of the same. *Fig.* 7, a stamen seen in front. *Fig.* 8, the same viewed sideways. *Fig.* 9, a stamen after the loss of its pollen and the contraction of its cells. *Fig.* 10, a transverse section of the same: *all magnified.* *Fig.* 11, transverse section of an anther, with its four included cells. *Fig.* 12, a grain of pollen: *highly magnified.* *Fig.* 13, the calyx. *Fig.* 14, a vertical section of the same, and of its included cup-shaped disk, with the pistil seated within it. *Fig.* 15, vertical section of the calyx, disk, and one-celled ovary, showing two ovules suspended from a free central placenta. *Fig.* 16, transverse section of the ovary. *Fig.* 17, the style and stigma, seen in front and sideways: *all magnified.*

B. Cathedra Gardneri. *Fig.* 18, the ovary somewhat grown, surrounded by the disk and calyx, and by two cup-shaped bracts. *Fig.* 19, the same more grown, the half of the disk, calyx, and bracts being cut away. *Fig.* 20, vertical section of the disk, calyx, and bracts: *all nearly the nat. size.*

PLATE 3.—LIRIOSMA.

A. LIRIOSMA VELLOZII, in flower. *Fig.* 1, a flower in bud. *Fig.* 2, the calyx. *Fig.* 3, two of the petals, half adherent by their margins. *Fig.* 4, a vertical section of the calyx, with two of the petals, one fertile and two sterile stamens, to show their position and place of insertion, the ovary being removed. *Fig.* 5, front and back view of a fertile stamen. *Fig.* 6, a sterile stamen. *Fig.* 7, vertical section of the calyx, showing the free ovary half included within it. *Fig.* 8, the entire pistil, removed. *Fig.* 9, vertical section of the one-celled ovary, showing the ovules suspended from a free central placenta. *Fig.* 10, transverse section of the same, showing the three suspended ovules. *Fig.* 11, vertical section of the same, with the ovules removed, to show the three incomplete septa, and the free central axile placenta: *all magnified.*

B. LIRIOSMA GARDNERIANA, in fruit. *Fig.* 12, the ripe drupe; here the persistent growing calyx is formed into a fleshy coating, which is become confluent with the ovary now converted into a nut. *Fig.* 13, the nut, with fleshy portion removed. *Fig.* 14, transverse section of the same. *Fig.* 15, the enclosed seed, with a longitudinal furrow, in which the withered placenta is imbedded by the pressure of growth; the two abortive ovules are seen in the apex, still attached to the summit of the placenta. *Fig.* 16, the same seen from above. *Fig.* 17, the placenta, with the two abortive ovules removed from the seed. *Fig.* 18, vertical section of the nucleus, showing the small embryo, enclosed near the summit of the copious albumen; the embryo is imbedded in a small cell, from the bottom of which the remains of the embryo-sac is seen descending along the axis of the albumen. *Fig.* 19, the embryo removed: *all nat. size.* *Fig.* 20, the embryo, *magnified.*

PLATE 4.—A. ICACINA GRANDIFOLIA, in flower.

Fig. 1, a flower with the corolla fallen away, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, vertical section of the same, showing the ovary, one-celled by abortion, supported by a small cupular disk, and the calyx, with two ovules suspended from a little below the summit of the cell.

B. ICACINA SENEGALENSIS. *Fig.* 4, a flower, *nat. size.* *Fig.* 5, the same, *magnified.* *Fig.* 6, the calyx. *Fig.* 7, petals, seen in three different positions. *Fig.* 8, a stamen with its semi-bilobed anther, seen anteriorly, posteriorly, and laterally, with a filament deprived of its anther: *all magnified.* *Fig.* 9, an anther, *more magnified.* *Fig.* 10, transverse section of the two-lobed anther, before and after dehiscence. *Fig.* 11, the pistil, with half the calyx cut away. *Fig.* 12, the ovary, showing the place of insertion of the stamens, two of the filaments being thrown back, to exhibit the five-lobed hypogynous disk. *Fig.* 13, vertical section of the ovary, showing two ovules suspended a little below the summit of the cell. *Fig.* 14, the stigma: *all magnified.*

C. ICACINA MAURITIANA. *Fig.* 15, a flower, *nat. size.* *Fig.* 16, the calyx. *Fig.* 17, two petals, to show their valvate æstivation. *Fig.* 18, a petal, back and front view. *Fig.* 19, a stamen, seen before and behind. *Fig.* 20, a filament with the anther removed. *Fig.* 21, transverse section of an anther: *all magnified.* *Fig.* 22, a pollen-grain, *highly magnified.* *Fig.* 23, the pistil, supported by its hypogynous disk, showing the ovary, gibbous in consequence of the abortion of two of its cells. *Fig.* 24, a vertical section of the same, with two ovules parietally attached and suspended from below the summit of the cell: *both magnified.*

PLATE 5.—A. APODYTES GARDNERIANA, in flower.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the calyx. *Fig.* 3, calyx and corolla, before dehiscence. *Fig.* 4, a petal. *Fig.* 5, stamens, seen in different positions. *Fig.* 6, the anther and filament, separated: *all magnified.* *Fig.* 7, pollen-grains, *highly magnified.* *Fig.* 8, the pistil. *Fig.* 9, vertical section of the same: *both magnified.*

B. APODYTES ACUTIFOLIA. *Fig.* 10, the pistil, *nat. size.* *Fig.* 11, the calyx, articulated on the pedicel. *Fig.* 12, the pistil, supported by its calyx. *Fig.* 13, vertical section of the same, with two ovules suspended from one side of the cell, below the summit. *Fig.* 14, the ovules removed: *all magnified.*

C. APODYTES DIMIDIATA. *Fig.* 15, a flower, *nat. size.* *Fig.* 16, the calyx. *Fig.* 17, a petal, seen before and behind. *Fig.* 18, a stamen seen in front and sideways, with a filament separated from the anther: *all magnified.* *Fig.* 19, the same, *more magnified.* *Fig.* 20, pollen-grains, *highly magnified.* *Fig.* 21, pistil, *magnified.* *Fig.* 22, the stigma, *more magnified.* *Fig.* 23, longitudinal section of the ovary, with two ovules suspended below the summit of the cell, *magnified.* *Fig.* 24, the two ovules removed, showing the placentary cup by which they are attached to the side of the cell, *more magnified.*

PLATE 6.—RHAPHIOSTYLIS HEUDELOTII.

Fig. 1, a flower in bud. *Fig.* 2, the same expanded: *both nat. size.* *Fig.* 3, the same, *magnified.* *Fig.* 4, a petal. *Fig.* 5, stamens, seen in front, sideways, and behind: *all magnified.* *Fig.* 6, grains of pollen, *highly magnified.* *Fig.* 7, the ovary, with the calyx half cut away to show the small hypogynous disk: the apical callus is formed by the rudiments of two abortive styles. *Fig.* 8, the same, seen sideways. *Fig.* 9, a vertical section of the same, showing the two collateral ovules suspended from near the apex of the cell: *all magnified.*

PLATE 7.—LERETIA VELLOZII.

Fig. 1, a flower in bud, *nat. size.* *Fig.* 2, the same expanded. *Fig.* 3, calyx with bract on articulated pedicel. *Fig.* 4, calyx only. *Fig.* 5, petal, seen on the inner face and sideways. *Fig.* 6, stamens: *all magnified.* *Fig.* 7, stamens, seen before and behind, *more magnified.* *Fig.* 7*, pollen-grains, *highly magnified.* *Fig.* 8, pistil with its hypogynous disk and surmounted by the style and the rudiments of two others which are abortive. *Fig.* 9, the same, *more magnified.* *Fig.* 10, vertical section of the same, with two collaterally suspended ovules. *Fig.* 11, transverse section of the same: *all magnified.* *Fig.* 12, hairs that cover the ovary, to show their markings, *more or less highly magnified.* *Figs.* 13, 14, 15, a fruit, section of the same, and the seed, *nat. size,* copied from the 'Flora Fluminensis.'

PLATE 8.—MAPPIA OVATA.

Fig. 1, a flower in bud, *nat. size.* *Fig.* 2, four of the petals with their apices introflexed, seen from within, and one of the alternate stamens. *Fig.* 3, a petal, seen externally. *Fig.* 4, stamens, seen before and behind. *Fig.* 5, transverse section of anthers, before and after dehiscence: *all magnified.* *Fig.* 6, grains of pollen, seen sideways and vertically, *more magnified.* *Fig.* 7, the ovary, seated within the disk. *Fig.* 8, longitudinal section of the same, showing the ovules suspended. *Fig.* 9, the disk: *all magnified.* *Fig.* 10, a fruit. *Fig.* 11, the seed. *Fig.* 12, longitudinal section of the same, showing the embryo enclosed in the albumen. *Fig.* 13, the embryo, seen in front and sideways: *all nat. size.*

Plate 9.—Desmostachys Planchonianus.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the calyx. *Fig.* 4, petals in different positions. *Fig.* 5, stamens. *Fig.* 6, pistil: *all magnified.* *Fig.* 7, stamen, seen in front. *Fig.* 8, the same, seen behind. *Fig.* 9, transverse section of anther. *Fig.* 10, the same after dehiscence. *Fig.* 11, stigma with portion of style. *Fig.* 12, the ovary seated in its disk, a filament showing its place of insertion, together with half the calyx. *Fig.* 13, a longitudinal section of the same, showing the ovules suspended: *all more magnified.*

Plate 10.—Poraqueiba Surinamensis.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, with two bracts at base, *magnified.* *Fig.* 3, the calyx with the bracts removed. *Fig.* 4, diagram showing the imbricated mode of æstivation of calyx. *Fig.* 5, longitudinal section of a flower in bud. *Fig.* 6, two petals, seen in front. *Fig.* 7, the same, viewed sideways. *Fig.* 8, two petals conjoined, showing the impressions made in them by their pressure on the stamens: *all magnified.* *Fig.* 9, transverse section of a flower in bud, across the anthers. *Fig.* 10, another transverse section, across the ovary. *Fig.* 11, a petal, viewed sideways. *Fig.* 12, the same, seen in front. *Fig.* 13, the same, with a stamen occupying the cavity on one side. *Fig.* 14, a stamen, viewed sideways. *Fig.* 15, a front view of the same. *Fig.* 16, a posterior view of the same. *Fig.* 17, transverse section of an anther, showing its four distinct cells. *Fig.* 18, the same after dehiscence. *Fig.* 19, the pistil. *Fig.* 20, longitudinal section of the same. *Fig.* 21, the ovules removed, in different positions: *all much magnified.*

Plate 11.—A. Pennantia Endlicheri.

Fig. 1, a fruit. *Fig.* 2, the putamen removed: *both nat. size.* *Fig.* 3, the same, *more magnified*, with an external cord on one side, running from the apex to the base. *Fig.* 4, longitudinal section of the same, with the seed removed, showing the external cord consisting of nourishing vessels and of the two abortive cells. *Fig.* 5, the seed seen from below, with half the putamen cut away, to show the basal chalaza and internal dorsal raphe. *Fig.* 6, lateral view of the seed, exhibiting the raphe with the apical strophiole, by which it is attached to the external cord, and its course to the basal chalaza. *Fig.* 7, longitudinal section of the albumen, showing the position and relative size of the embryo: *all magnified.* *Fig.* 8, the embryo removed, *more magnified.*

B. Details of Pennantia corymbosa. *Fig.* 9, a flower in bud, *nat. size.* *Fig.* 10, the same, *magnified.* *Fig.* 11, the same expanded. *Fig.* 12, a stamen in æstivation. *Fig.* 13, the same expanded: *all magnified.* *Fig.* 14, an anther, showing the separation of its lobes by a thin connective. *Fig.* 15, a transverse section of the same. *Fig.* 16, the same after dehiscence. *Fig.* 17, grains of pollen. *Fig.* 18, the ovary seated upon its disk. *Fig.* 19, the same, with the disk removed: *all more highly magnified.* *Fig.* 20, a fruit. *Fig.* 21, the putamen, with the sarcocarp removed: *both nat. size.* *Fig.* 22, a fruit, *magnified.* *Fig.* 23, the torus and persistent disk that supports the fruit. *Fig.* 24, the putamen, showing the channel filled with the cord consisting of the nourishing vessels and abortive cells. *Fig.* 25, the abortive cells and nourishing vessels removed. *Fig.* 26, a front view of fig. 24. *Fig.* 27, transverse section of the same. *Fig.* 28, longitudinal section of the putamen, showing the nourishing vessels in connexion with the dorsal raphe of the seed. *Fig.* 29, longitudinal section of the putamen with the seed removed, showing the foramen through which the nourishing vessels pass. *Fig.* 30, the seed removed, with the dorsal raphe and apical strophiole. *Fig.* 31, the same, seen from the dorsal side, with the raphe and basal chalaza. *Fig.* 32, longitudinal section of the albumen, showing the enclosed embryo. *Fig.* 33, the embryo extracted: *all magnified.* *Fig.* 34, the embryo in two positions, *more highly magnified.*

Plate 12.—Pennantia Cunninghami, in flower and in fruit.

Fig. 1, a flower in bud, *nat. size.* *Fig.* 2, the same. *Fig.* 3, the same expanded. *Fig.* 4, the petals. *Fig.* 5, two of the stamens. *Fig.* 6, the pistil: *all equally magnified.* *Fig.* 7, a stamen, seen from behind. *Fig.* 8, the same, seen sideways. *Fig.* 9, an anther, seen in front, showing the separation of its lobes by the connective. *Fig.* 10, transverse section of the same. *Fig.* 11, a filament. *Fig.* 12, the pistil supported by its disk on the torus. *Fig.* 13, the pistil removed. *Fig.* 14, longitudinal section of the same, showing two collateral suspended ovules. *Fig.* 15, one of the suspended ovules: *all more or less magnified.* *Fig.* 16, a fruit, *nat. size.* *Fig.* 17, the fruit seen from below, with half of the sarcocarp and of the putamen removed, showing the remains of the two abortive cells, the basal chalaza, and the dorsal raphe. *Fig.* 18, its putamen. *Fig.* 19, longitudinal section of the same. *Fig.* 20, its enclosed seed, removed. *Fig.* 21, longitudinal section of the albumen. *Fig.* 22, the embryo extracted from it: *all nat. size.* *Fig.* 23, the same, *magnified.* *Fig.* 23 *bis*, another fruit, which, contrary to the ordinary custom, is 2-celled. *Fig.* 24, the osseous putamen. *Fig.* 25, longitudinal section of the same, showing the two equal cells, and a seed in each cell, suspended by its strophiole from the summit of the thin membranaceous dissepiment. *Fig.* 26, transverse section of the same, with the seeds removed, showing half of the dissepiment with the imbedded cord of the nourishing vessels which is left entire. *Fig.* 27, the cord, composed of the two strophioles, the nourishing vessels, and the third abortive cell, extracted from the middle of the dissepiment. *Fig.* 28, the two seeds removed: *all nat. size.*

Plate 13.—A. Stemonurus axillaris.

Fig. 1, a flower in bud, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, two of the petals, valvate in æstivation, with their apices deeply introflexed. *Fig.* 4, a stamen seen in front. *Fig.* 5, a filament, with the anther removed, seen sideways and behind: *all magnified.* *Fig.* 6, grains of pollen, *very highly magnified.* *Fig.* 7, the pistil supported on its disk, *magnified.* *Fig.* 8, the same, seated in the calyx, half of which is cut away. *Fig.* 9, longitudinal section of the same, showing two ovules collaterally suspended from near the summit of the cell: *both more magnified.*

B. Stemonurus Gardneri.

Fig. 1, a flower in bud, *nat. size.* *Fig.* 2, the calyx, *magnified.* *Fig.* 3, petals in different positions. *Fig.* 4, the stamens: *all magnified.* *Fig.* 5, stamens seen in three different positions. *Fig.* 6, a filament, seen before and behind. *Fig.* 7, the ovary: *all more magnified.* *Fig.* 8, the sessile stigmata, persistent on the summit of the fruit, *magnified.* *Fig.* 9, a fruit, *nat. size.* *Fig.* 10, the putamen, seen in three positions, to show the lateral channel containing the cord of nourishing vessels and two abortive cells: *nat. size.* *Fig.* 11, a longitudinal section of the putamen, with the seed removed, showing the groove in which the cord lies, and the foramen through which it passes. *Fig.* 12, the seed, with its dorsal raphe in connexion with the cord of nourishing vessels. *Fig.* 13, the same, seen on the dorsal face, with the cord removed, showing the singularly sub-peripheral course of the raphe. *Fig.* 14, the testa removed from the seed, showing its imbedded raphe. *Fig.* 15, the albumen with the integuments removed. *Fig.* 16, transverse section of the albumen, showing a central hollow space. *Fig.* 17, longitudinal section of the last, showing the same hollow space filled with a layer of cellular tissue, the minute embryo being seen in the summit. *Fig.* 18, the embryo extracted: *all equally magnified. Fig.* 19, the embryo, *more magnified.*

Plate 14.—A. Stemonurus Ceylanicus.

Fig. 1, a flower in bud, *nat. size. Fig.* 2, the same, *magnified. Fig.* 3, the same, opening. *Fig.* 4, two of the petals, valvate in æstivation, with their apices introflexed. *Fig.* 5, a stamen, seen in front. *Fig.* 6, the same, seen behind. *Fig.* 7, the same, with the anther removed: *all magnified. Fig.* 8, transverse section of an anther. *Fig.* 9, hairs upon the filaments: *all highly magnified. Fig.* 10, the calyx. *Fig.* 11, the same, enclosing the sterile pistil. *Fig.* 12, longitudinal section of the same: *all magnified.*

B. Stemonurus Walkeri.

Fig. 1, a male flower in bud, *nat. size. Fig.* 2, the same, *magnified. Fig.* 3, two of the petals, with their summits introflexed. *Fig.* 4, a stamen, seen in three positions. *Fig.* 5, a filament, seen behind: *all magnified. Fig.* 6, transverse section of an anther. *Fig.* 7, a grain of pollen: *both more magnified. Fig.* 8, the sterile ovary, *magnified. Fig.* 9, a fertile hermaphrodite flower, in bud, *nat. size. Fig.* 10, the same, *magnified. Fig.* 11, two of the petals. *Fig.* 12, a stamen: *all magnified. Fig.* 13, stamen, seen in three positions, *more magnified. Fig.* 14, the fertile pistil, *magnified. Fig.* 15, the same, seated on its disk within the calyx, which is half cut away. *Fig.* 16, longitudinal section of the same, showing its two collateral ovules suspended from near the summit of the cell: *both more magnified.*

Plate 15.—Stemonurus affinis.

Fig. 1, a flower, *nat. size. Fig.* 2, the same, *magnified. Fig.* 3, a petal. *Fig.* 4, a stamen: *both magnified. Fig.* 5, the same. *Fig.* 6, a filament: *both more magnified. Fig.* 7, the pistil, *magnified. Fig.* 8, the same. *Fig.* 9, longitudinal section of the same, showing two suspended ovules: *both more magnified.*

Plate 16.—Platea laxiflora.

Fig. 1, a flower, *nat. size. Fig.* 2, calyx, pedicel, and bract. *Fig.* 3, petal. *Fig.* 4, two of the stamens. *Fig.* 5, the pistil: *all magnified. Fig.* 6, the calyx, pedicel, and bract. *Fig.* 7, stamens. *Fig.* 8, the pistil. *Fig.* 9, longitudinal section of the same: *all more magnified.*

Plate 17.—Platea Lobbiana.

Fig. 1, a flower, *nat. size. Fig.* 2, a flower bursting. *Fig.* 3, the same expanded. *Fig.* 4, the calyx. *Fig.* 5, a petal. *Fig.* 6, one of the stamens, placed between two of the petals. *Fig.* 7, a stamen, seen before and behind. *Fig.* 8, the pistil: *all magnified. Fig.* 9, the same. *Fig.* 10, longitudinal section of the same, showing the two collateral ovules suspended from near the summit of the cell: *both more magnified.*

Plate 18.—Sarcostigma Kleinii.

Fig. 1, a flower, *nat. size. Fig.* 2, the same. *Fig.* 3, two of the petals. *Fig.* 4, a stamen. *Fig.* 5, pistil and stamens upon the hypogynous disk: *all magnified. Fig.* 6, the calyx. *Fig.* 7, petals, seen before and behind. *Fig.* 8, ovary, disk, and stamens: *all* *more magnified. Fig.* 9, stamens in different positions, *still more magnified. Fig.* 10, the pistil. *Fig.* 11, longitudinal section of the same, showing the two suspended ovules: *both magnified. Fig.* 12, the fruit, *nat. size.*

Plate 19.—Sarcostigma Vogelii.

Fig. 1, transverse section, from a sketch by Dr. Vogel, showing another instance of a 2-celled fruit, as before shown in *Pennantia Cunninghami.*

Plate 20.—Discophora Guianensis.

Fig. 1, a flower. *Fig.* 2, the calyx. *Fig.* 3, a petal. *Fig.* 4, the ovary. *Fig.* 5, longitudinal section of the same: *all nat. size. Fig.* 6, the same, *magnified.*

Plate 21.—A. Emmotum fagifolium.

Fig. 1, a flower expanded, *nat. size. Fig.* 2, the same, *magnified. Fig.* 3, the calyx, showing its articulation on the pedicel. *Fig.* 4, a petal, seen from within. *Fig.* 5, outside of the same. *Fig.* 6, the same, viewed sideways. *Fig.* 7, a stamen: *all magnified. Fig.* 8, stamens, seen in different positions. *Fig.* 9, an anther, before dehiscence. *Fig.* 10, a filament. *Fig.* 11, transverse section of anthers, showing their peculiar mode of dehiscence: *all more magnified. Fig.* 12, the pistil, *magnified. Fig.* 13, the stigma. *Fig.* 14, longitudinal section of the same. *Fig.* 15, longitudinal section of the ovary, showing one of the cells with two suspended ovules. *Fig.* 16, transverse section of the same, showing its five cells, two of which are abortive: *all more magnified.*

B. Emmotum acuminatum.

Fig. 1, a petal, outside view. *Fig.* 2, the same, seen sideways. *Fig.* 3, the same, seen from within. *Fig.* 4, a stamen. *Fig.* 5, the pistil: *all magnified. Fig.* 6, the stigma. *Fig.* 7, stamens, seen in different positions, *more magnified. Fig.* 8, transverse section of anthers before and after dehiscence, *still more magnified. Fig.* 9, transverse section of the ovary, showing its five cells, where two of them are abortive, *magnified. Fig.* 10, a fruit, seen sideways. *Fig.* 11, the same, viewed from above. *Fig.* 12, transverse section of the same, showing its drupaceous nut, with five cells, in four of which the seeds were evidently withered: *all nat. size.*—The details of the fruit were obtained subsequently to the printing of the type in p. 177, and were obtained from a specimen among Mr. Spruce's collections from the Rio Negro, No. 1989: it is an additional proof in confirmation of the true structure and affinity of the *Icacinaceæ* as shown in this volume.

Plate 22.—A. Emmotum nitens.

Fig. 1, a flower expanded, *nat. size. Fig.* 2, the same, *magnified. Fig.* 3, the calyx. *Fig.* 4, pistil and disk, seated in the calyx, half of which is cut away: *all magnified. Fig.* 5, vertical section of a flower, with the ovary and disk entire. *Fig.* 6, a vertical section of the ovary, showing one of the cells with two suspended ovules. *Fig.* 7, transverse section of the ovary, showing three fertile and two abortive cells. *Fig.* 8, the stigma: *all more magnified. Fig.* 9, a stamen seen sideways. *Fig.* 10, the same after dehiscence. *Fig.* 11, a stamen seen in front. *Fig.* 12, a back view of the same. *Fig.* 13, transverse section of an anther. *Fig.* 14, the same after dehiscence. *Fig.* 16, the filaments: *all still more magnified. Fig.* 15, grains of pollen, *very highly magnified.*

B. EMMOTUM GLABRUM.

Fig. 1, a flower in bud. *Fig.* 2, the same, expanded: *both nat. size.* *Fig.* 3, the calyx. *Fig.* 4, an inner view of petal. *Fig.* 5, side view of the same. *Fig.* 6, stamens, seen sideways and in front. *Fig.* 7, filaments, seen in front and sideways. *Fig.* 8, the pistil: *all magnified.*

PLATE 23.—A. CANELLA ALBA.

Fig. 1, seed, seen sideways. *Fig.* 2, the same, seen on its edge, showing the hilum: *both nat. size.* *Fig.* 3, the same, *magnified.* *Fig.* 4, a seed, with the outer crustaceous shell (arillus) cut in half, showing the relative position of the raphe upon the inner coating. *Fig.* 5, the testa, with the raphe and chalaza. *Fig.* 6, side view of the same. *Fig.* 7, longitudinal section of the albumen. *Fig.* 8, the embryo, extracted: *all magnified.*

B. CANELLA OBTUSIFOLIA.

Fig. 1, a flower expanded. *Fig.* 2, the calyx of three sepals. *Fig.* 3, the five petals. *Fig.* 4, the monadelphous tube of stamens. *Fig.* 5, the pistil: *all nat. size.* *Fig.* 6, one of the anthers removed from staminal tube, *magnified.* *Fig.* 7, transverse section of the same, before and after dehiscence. *Fig.* 8, the entire staminal tube. *Fig.* 9, longitudinal section of the same, with the included pistil: *all magnified.* *Fig.* 10, longitudinal section of the ovary, showing two ovules attached to one of the parietal lines of placenta. *Fig.* 12, the placenta, removed. *Fig.* 13, the ovules, removed. *Fig.* 11, a transverse section of ovary, showing the two placentary lines, with the ovules attached: *all more magnified.* *Fig.* 14, diagram of the flower, to show the mode of æstivation.

PLATE 24.—A. CINNAMODENDRON AXILLARE.

Fig. 1, a flower, *magnified.* *Fig.* 2, the calyx. *Fig.* 3, the flower expanded. *Fig.* 4, the outer row of petals. *Fig.* 5, the inner row of petals. *Fig.* 6, the pistil. *Fig.* 7, longitudinal section of the same, showing ovules attached to one of the parietal lines of placenta: *all magnified.*

B. CINNAMODENDRON CORTICOSUM.

Fig. 1, a flower. *Fig.* 2, the calyx: *both nat. size.* *Fig.* 3, a flower, seen from above, to show the manner of æstivation, *magnified.* *Fig.* 4, the same, expanded. *Fig.* 5, the same, seen sideways. *Fig.* 6, two of the sepals. *Fig.* 7, the outer row of petals. *Fig.* 8, the inner row of petals. *Fig.* 9, the monadelphous tube of stamens. *Fig.* 10, the same cut open: *all magnified.* *Fig.* 11, a portion of the same, *more magnified.* *Fig.* 12, the pistil seated in its disk. *Fig.* 13, a transverse section of the same: *all magnified.* *Fig.* 14, a berry. *Fig.* 15, a seed: *both nat. size.* *Fig.* 16, the same. *Fig.* 17, the same, with the outer crustaceous coating (arillus) removed, showing the raphe and chalaza upon the internal testa. *Fig.* 18, longitudinal section of the albumen. *Fig.* 19, the embryo: *all more or less magnified.*

PLATE 25.—A. DRIMYS WINTERI.

B. DRIMYS BRASILIENSIS.

Plate 26.—A. Drimys angustifolia.

B. Drimys retorta.

C. Drimys Chilensis.

Fig. 1, a flower in bud. *Fig.* 2, the same, with the calyx ruptured in the apex, and becoming divided into two lobes. *Fig.* 3, a flower expanded. *Fig.* 4, a petal. *Fig.* 5, the calyx with the included stamens, the petals being removed. *Fig.* 6, three of the stamens: *all nat. size.* *Fig.* 7, a stamen seen before and behind. *Fig.* 8, transverse section across the anther, before expansion. *Fig.* 9, the same after dehiscence: *all magnified.* *Fig.* 10, the five pistilla, seated on the staminiferous torus, with the stamens removed, *nat. size.* *Fig.* 11, the same, *magnified.* *Fig.* 12, an ovary. *Fig.* 13, a longitudinal section of the same, showing the ovules attached collaterally to a long parietal ventral placenta. *Fig.* 14, a transverse section of the same: *all more magnified.* *Fig.* 15, the ripe fruits, *nat. size.* *Fig.* 16, a single berry. *Fig.* 17, a longitudinal section of the same. *Fig.* 18, two of the seeds: *all nat. size.* *Fig.* 19, the same, *magnified.* *Fig.* 20, the same, with the outer crustaceous shell (arillus) removed, and showing the raphe detached upon the inner testa, and the chalaza. *Fig.* 21, the same, with the membranaceous testa removed, showing the tegmen and chalaza. *Fig.* 22, longitudinal section of the albumen, showing the minute embryo imbedded near its summit. *Fig.* 23, the minute embryo detached: *all magnified.* *Fig.* 24, embryo, *highly magnified.*

Plate 27.—A. Drimys Granatensis.

B. Drimys Fernandesianus.

C. Illicium anisatum.

Fig. 1, a fruit. *Fig.* 2, one of its follicles, detached. *Fig.* 3, the same after dehiscence. *Fig.* 4, a longitudinal section of the same, showing the included seed. *Fig.* 5, the seed; *all nat. size.* *Fig.* 6, the same, *magnified.* *Fig.* 7, the same, seen endways, showing the hilum. *Fig.* 8, a seed, with half of the outer crustaceous coating cut away, showing the included fleshy testa. *Fig.* 9, the testa. *Fig.* 10, the same seen edgeways. *Fig.* 11, longitudinal section of the testa, showing the raphe imbedded in its substance, as well as the chalaza and tegmen enveloped by it. *Fig.* 12, the hilar and more fleshy end of the testa separated, to show the raphe; also the remainder of the fleshy testa, with the chalaza. *Fig.* 13, the tegmen and chalaza. *Fig.* 14, longitudinal section of the albumen, showing the minute embryo imbedded near its hilar extremity: *all magnified.* *Fig.* 15, the embryo, *highly magnified.*

Plate 28.—Lardizabala sylvicola, ♀ in flower and in fruit.

Fig. 1, the three outer sepals. *Fig.* 2, the three inner sepals. *Fig.* 3, the six petals. *Fig.* 4, the three sterile stamens. *Fig.* 5, the three pistils: *all nat. size.* *Fig.* 6, transverse section of one of the ovaries, showing its six lines of parietal placentation. *Fig.* 7, three of the ovules: *both magnified.* *Fig.* 8, transverse section of a fruit, showing the seeds imbedded in pulp. *Fig.* 9, some of the seeds, seen in different positions: *both nat. size.* *Fig.* 10, a longitudinal section of a seed. *Fig.* 11, a transverse section of the same: *both magnified*, the same letters of reference being applicable to both: *a* is the outer crustaceous coating of the seed, which is evidently an *arillus*, because it does not partake of the inflexion of the other proper integuments, and is in no way connected with the raphe; it is also external to the placentary expansion *e*, to which the seed is attached; *b*, *b*, the two proper membranaceous tunics of the seed (*testa* and *tegmen*), which by their inflexion closely invest the albumen all over its external surface, as well as upon its large hollow central cavity; *c*, the *albumen* with its large hollow central space; *d*, part of the inflected portion of the *testa*, in form of a curved tubular channel in which the spiral vessels of the *raphe* are imbedded; this raphigerous tube is in no way connected with the external crustaceous arilloid shell, but is attached to the fungous expansion of the placenta, *e*, which partly fills the hollow central space of the seed; in the fruit, the fungous expansion, *e*, is connected with the placenta through the hilar aperture of the external shell: *f* is the minute *embryo*, with the cotyledons directed to the chalaza and to the centre of the seed. *Fig.* 12, the embryo, *much more magnified.*

PLATE 29.—A. Details of STYRAX OFFICINALE.

Fig. 1, a flower expanded. *Fig.* 2, two of the petals. *Fig.* 3, the stamens: *all nat. size.* *Fig.* 4, a stamen seen sideways, in front, and from behind, showing two parallel cells separated by an interval, and dorsally attached by their entire length to the filament. *Fig.* 5, a transverse section across the anther: *both magnified.* *Fig.* 6, the pistil, with half of the calyx cut away, *nat. size.* *Fig.* 7, the stigma with a portion of the style, *magnified.* *Fig.* 8, longitudinal section of the ovary, with its unilocular space, and its free central placenta, to which the ovules are attached in three series. *Fig.* 9, the same, with the ovules removed, showing the central placenta, and the three narrow rudimentary and incomplete dissepiments: *both magnified.* *Fig.* 10, a seed seen sideways, showing the basal and somewhat lateral hilum. *Fig.* 11, the same, seen from below, showing the hilum and the open aperture into the raphigerous channel, and the three longitudinal marks produced by the impression of the three incomplete dissepiments of the pericarpal covering. *Fig.* 12, the seed removed from its osseous testa last described: *all nat. size.* *Fig.* 13, a longitudinal section of the osseous testa, with the hilar portion left to show the aperture into the short raphigerous tube imbedded in the base of the shell. *Fig.* 14, the same, cut across the hilum, to show the basal raphigerous channel, and the mode in which the vessels of the raphe become rapidly subdivided into an araneiform network of white spiral threads, which partly adhere to the inner surface of the osseous testa, and to the outer surface of the membranaceous integument that closely invests the albumen, as seen in *fig.* 15. *Fig.* 16, a longitudinal section of the albumen across the place of the hilum, showing the enclosed embryo lying across the hilum, with the cotyledons parallel to it. *Fig.* 17, a transverse section of the same, in a line parallel to the embryo, which is shown in its natural position: *all magnified.*

B. Details of STYRAX ODORATISSIMUM.

Fig. 1, a flower. *Fig.* 2, the corolla cut open, showing the position of the stamens. *Fig.* 3, imbricated mode of æstivation of the petals: *all nat. size.* *Fig.* 4, a stamen seen in different positions, showing the distinct parallel cells of the anther dorsally attached to the broad filament, *magnified.* *Fig.* 5, the pistil, with half of the calyx removed. *Fig.* 6, a fruit. *Fig.* 7, the same, seen from below: *all nat. size.*

C. Details of STYRAX PORTERIANUM.

Fig. 1, the calyx. *Fig.* 2, the corolla cut open, showing the petals slightly attached at base by the attachment of the foot of the stamens: *both nat. size.* *Fig.* 3, diagram showing the imbricated mode of æstivation of petals. *Fig.* 4, four of the stamens, showing the manner of their agglutination to the petals, *magnified.* *Fig.* 5, pistil, with half of the calyx removed, *nat. size. Fig.* 6, the pistil. *Fig.* 7, longitudinal section of the same, showing it to be unilocular, with a basal free central placenta, to which are attached its three series of ovules and the rudimentary dissepiments; the summit of the covering of the cell is much thickened and depressed, bearing some resemblance to an epigynous disk. *Fig.* 8, a transverse section, showing the same parts: *all magnified.*

D. Details of Cyrta agrestis.

Fig. 1, a flower. *Fig.* 2, the corolla cut open, showing the stamens attached to the otherwise free petals: *both nat. size. Fig.* 3, a stamen, seen in front, *magnified. Fig.* 4, the calyx, *nat. size. Fig.* 5, longitudinal section of calyx and ovary, *magnified.*

E. Details of Cyrta dealbata.

Fig. 1, a flower in bud. *Fig.* 2, the same expanded. *Fig.* 3, the pistil: *all nat. size. Fig.* 4, the four petals. *Fig.* 5, diagram showing their valvate mode of æstivation. *Fig.* 6, the eight stamens: *all magnified. Fig.* 7, four of the stamens, showing attachment of the base of the filaments, and the two distinct cells of each anther separated by an interval and dorsally attached by their entire length upon the broad filament. *Fig.* 8, a stamen, seen sideways: *all more magnified. Fig.* 9, the ovary, with half of the calyx removed. *Fig.* 10, longitudinal section of the unilocular ovary, showing the central basal placenta, ovules in three series, and the rudimentary dissepiments: *both magnified.*

F. Details of Cyrta suberifolia.

Fig. 1, a flower in bud, *nat. size. Fig.* 2, diagram showing the valvate mode of æstivation of the petals. *Fig.* 3, the corolla cut open, showing the position of the stamens. *Fig.* 4, the pistil, with half of the calyx removed: *both nat. size. Fig.* 5, the stigma and portion of the style. *Fig.* 6, a stamen seen before and behind, showing the entire attachment of the two distinct anther-cells: *both magnified. Fig.* 7, a fruit. *Fig.* 8, the same, showing the valvular dehiscence of its pericarp, which is unilocular and monospermous. *Fig.* 9, the seed removed. *Fig.* 10, the same, with the outer integument removed, showing the apical chalaza. *Fig.* 11, a longitudinal section of the albumen, showing the embryo enclosed in it. *Fig.* 12, the embryo removed, seen sideways: *all nat. size.*

G. Details of Pamphilia styracifolia.

Fig. 1, a male flower, *nat. size. Fig.* 2, corolla of a male flower cut open, showing the position of the stamens, free nearly to the base, *magnified. Fig.* 3, a female flower, *nat. size. Fig.* 4, the same, *magnified. Fig.* 5, corolla of the same, in the act of bursting open. *Fig.* 6, diagram of the corolla in bud, showing its valvate mode of æstivation. *Fig.* 7, corolla of the same, cut open, showing the position of the stamens. *Fig.* 8, portion of the same, *more magnified,* showing four of the stamens and a petal; the filaments are much broader than the two cells of each anther, which are separated by a wide interval, and dorsally attached by their whole length to the filament; the filaments are united in a monadelphous tube up to the level of the anthers, which is free from the petals, which again are also free from one another, except at the very base, where a short portion of the staminal tube holds them together slightly. *Fig.* 9, transverse section of a stamen, across the anther, showing the attachment of its two separate cells upon the much broader filament, and the line of their dehiscence in front. *Fig.* 10, a longitudinal section of the unilocular ovary, showing the position of its three erect ovules, on a depressed central placenta, the ovules standing in as many incomplete cells, formed by the rudimentary dissepiments. *Fig.* 11, a transverse section of the same, showing the same parts: *all greatly magnified.* *Fig.* 12, stellate hairs covering the petals and calyx.

PLATE 30.—A. STRIGILIA LÆVIS, in flower.

Fig. 1, a flower. *Fig.* 2, the corolla cut open, showing the position of the stamens. *Fig.* 3, a petal. *Fig.* 4, a stamen. *Fig.* 5, the pistil: *all nat. size.* *Fig.* 6, two of the petals, showing their valvate mode of æstivation. *Fig.* 7, stamens seen in different positions; the two anther-cells, separated by a distinct interval, are nearly the width of the filaments, which are conspicuously broader, the cells being dorsally attached by their entire length. *Fig.* 8, transverse sections of the same across the anthers, before and after dehiscence. *Fig.* 9, pollen-grains. *Fig.* 10, the ovary seated on the torus, with the tube of the calyx removed. *Fig.* 11, longitudinal section of the same: *all magnified.* *Fig.* 12, the same, *more magnified*, showing its unilocular cell, with the elevated central placenta, the three incomplete dissepiments, and the ovules attached to the placenta in three series; the summit of the cell is depressed and much thickened, as shown in *Styrax Porterianum* (Plate 29 c). *Fig.* 13, a transverse section of the same, showing the same parts; the glandular processes of the placenta are here shown, in the middle of which the ovules are attached. *Fig.* 14, a longitudinal section of the same, with the ovules removed, showing more distinctly the central free placenta, with the incomplete dissepiments. *Fig.* 15, the placenta removed, showing the three series of ovules. *Fig.* 16, a longitudinal section of the placenta, showing the mode of attachment of the ovules. *Fig.* 17, the stigma, and portion of the style: *all more or less highly magnified.*

B. STRIGILIA LÆVIS, in fruit.

Fig. 18, the ripe drupe enclosed in the persistent calyx. *Fig.* 19, the same, with the calyx removed. *Fig.* 20, the corneous shell of the endocarp with its ornamental spots and the lines of the shrivelled incomplete dissepiments. *Fig.* 21, the seed attached to the torus, with the pericarp and calyx removed. *Fig.* 22, the same, showing the scar left by the breaking of the base of the osseous testa. *Fig.* 23, the seed, with the integuments covered by the araneiform network of the branching raphe. *Fig.* 24, the albumen. *Fig.* 25, longitudinal section of the same, with the enclosed embryo. *Fig.* 26, the embryo extracted, seen in front and edgeways: *all nat. size.* *Fig.* 27, portion of the osseous testa, where it breaks away from its persistent base, showing the scar with the raphigerous aperture on one side: the corresponding part of this channel is seen in the lower detached portion of the shell; and beneath this again are found the abortive ovules, still attached to the original placenta, a single ovule only having been fertilized and grown to maturity: the intermediate cup which bears the abortive ovules is therefore a portion of the pericarpal covering, the lower cup being part of the calyx. *Fig.* 28, a longitudinal section of a portion of the osseous testa, showing the channel through which the raphe proceeds from the placenta, at first as a simple cord, which by degrees becomes subdivided into innumerable ramifications, forming at length a dense cottony web of white spiral threads distributed over the inner surface of the testa: *both magnified.*

PLATE 31.—A. Details of HALESIA TETRAPTERA.

Fig. 1, a flower in bud, showing the very imbricated æstivation of the corolla, as in *Styrax.* *Fig.* 2, the same expanded. *Fig.* 3, the corolla cut open, showing the position and relative size of the stamens. *Fig.* 4, the pistil enclosed in the calyx, the ovary being at first half superior: *all nat. size.* *Fig.* 5, two of the stamens, the filaments being nearly free to the base: the anther and its mode of attachment are here shown before and behind, its two parallel cells being separated by a distinct interval; the filament is here comparatively narrow. *Fig.* 6, a longitudinal section of the half-superior unilocular ovary, the lower moiety being adnate to the tube of the calyx; the placenta is central, free, and a quarter the length of the cell, and the ovules are attached to its summit in two series, the upper series being erect, the lower one suspended; three of its four incomplete dissepiments are seen, and the summit of the wall of the ovary is thickened. *Fig.* 7, the same, with the ovules removed, in order to show more distinctly the placenta and incomplete dissepiments. *Fig.* 8, a transverse section of the ovary, cut across the line of the summit of the placenta, showing the ovules, the four incomplete cells in the base, and the eight nervures of the adnate calyx, four of which afterwards, in the seed, become expanded into as many broad wings: *all much magnified.* *Fig.* 9, a longitudinal section of the ovary shortly after the fall of the corolla. *Fig.* 10, the same, as seen a month after the same period; here the upper free moiety of the ovary has scarcely attained any increment, but there has been a considerable downward growth of its lower moiety, by which the placenta has become drawn to one side, thus assuming a parietal position, and one or two of the ovules, being fertilized, have increased in size, while all the others remain abortive and unchanged. *Fig.* 11, the same, as it appears six weeks after the fall of the corolla. *Fig.* 12, the same, after a period of nearly five months, at which time the placenta has grown over the ovule, in the form of a parietal cell, which generally becomes ossified, and the mature seed becomes either erect or suspended, accordingly as it has been developed from an erect or pendent ovule, as shown in fig. 6: the external wings are now beginning to appear; it will be seen that up to the latest period there has been no increment of the upper free moiety of the ovule, and that the whole extent of development has been confined to the extensive downward growth of its lower moiety. *Fig.* 13, a ripe four-winged seed. *Fig.* 14, a transverse section of the same (the upper portion), showing the fleshy pericarp with the endocarp transformed into an osseous nut, which is unilocular, with two parietal seminiferous pseudo-cells on one of its sides. *Fig.* 15, the lower portion of the same. *Fig.* 16, a fruit with one of the wings and half of the sarcocarp removed, to show the position and relative size of the nut. *Fig.* 17, the osseous spindle-shaped nut. *Fig.* 18, a longitudinal section of the same, showing the parietal pseudo-cell containing a single seed: *all nat. size.* *Fig.* 19, longitudinal section of the osseous nut, *magnified*, showing one of the parietal osseous pseudo-cells, containing a single erect ovule: it is seen how the newly formed parietal crustaceous cell becomes agglutinated with the osseous endocarp, and how the main body of the ovular development remains always unilocular, with the vestiges of the now elongated incomplete dissepiments still remaining visible on the side of the pseudo-cells; the axile thread of nourishing vessels is still to be traced along the outside of the pseudo-cells, and in communication with the raphe at the side which always faces that line. *Fig.* 20, a transverse section of the same, showing two osseous pseudo-cells and two other membranaceous cells, where the fertilized ovules have withered after a short period of growth: one of the osseous cells contains a perfect erect seed, the other a suspended seed; and in the angle outside of these pseudo-cells is observed the cord of nourishing vessels, originally seen in the central placenta of the ovary: facing this line, the raphe of each seed is constantly found communicating with it through the medium of the hilar attachment of the seed: *all magnified.* *Fig.* 21, a seed, *nat. size.* *Fig.* 22, the same (a pendent seed), *magnified*: the hilum is apical, and the vessels of the raphe are confined within a longitudinal simple cord, that extends from the base to the apex of the outer thin membranaceous tunic or *testa.* *Fig.* 23, the same, with the outer tunic removed, and covered by the inner integument (*tegmen*); the chalaza is seen at its lower extremity; on its summit is observed a free thread, which appears like a *suspensor,* and which corresponds in position with the hilum of the testa. *Fig.* 24, the same, seen from below, showing the *chalaza. Fig.* 25, longitudinal section of the albumen in the same, with the enclosed embryo, seen on its edge. *Fig.* 26, the embryo extracted, seen on its face: *all magnified.*

B. Details of Pterostyrax corymbosum.

Fig. 1, a flower. *Fig.* 2, the five free petals. *Fig.* 3, the ten stamens. *Fig.* 4, the pistil enclosed in the calyx: *all nat. size. Fig.* 5, four of the petals. *Fig.* 6, five of the stamens, whose construction is similar to that described in *Halesia. Fig.* 7, the pistil enclosed in the calyx, the upper half of the ovary being free; the lower half is adnate to the tube of the calyx: *all magnified equally. Fig.* 8, the stigma, *more magnified. Fig.* 9, a longitudinal section of the ovary as seen in fig. 7: its internal structure is exactly similar to that described in *Halesia. Fig.* 10, the same, with the ovules removed, to show the central placenta and incomplete dissepiments. *Fig.* 11, a transverse section of the same across the placenta. *Fig.* 12, a transverse section of the same across the upper or unilocular portion of the ovary, just above the line of the placenta, with the carinated nervures of the adnate tube of the calyx, which afterwards grow into wings upon the seed. *Fig.* 13, a transverse section of the upper free portion of the ovule below the style, with the extremities of the ovules shown in their position: *all magnified. Fig.* 14, a four-winged seed. *Fig.* 15, a longitudinal section of the nut: *both nat. size. Fig.* 16, transverse section of a fruit, showing an internal structure similar to that described in *Halesia*: *magnified.*

Plate 32.—Diclidanthera elliptica.

Fig. 1, a flower in bud, showing its twisted æstivation. *Fig.* 2, the same expanded. *Fig.* 3, a corolla cut open. *Fig.* 4, the pistil, seated in the calyx, half of which is cut away: *all nat. size. Fig.* 5, a corolla cut open, *magnified*: here the petals above the line of the anthers are quite free; but below this they are pseudo-gamopetalous by the adhesion of the very thin membranaceous monadelphous tube of the stamens; when this tube is torn away, the petals become free to the base, there being no mutual agglutination of their margins, which are contorsively imbricated and overlap each other: the dextral or exterior margin, not being in contact with the staminal tube, is always free; it is therefore incorrect to say that the corolla is gamopetalous. *Fig.* 6, the pistil, with the ovary supported on a stipitate base within the free calyx: *both magnified. Fig.* 7, upper portion of the very thin monadelphous tube of the stamens, separated from its adhesion to the petals, showing the summits of the united filaments to be free, each bearing an erect two-celled anther, which bursts by a transverse apical furrow into two somewhat unequal valves; in its dehiscence, the posterior valve remains erect, and the anterior valve becomes quite reflected; the filamentous tube is pubescent within: *more magnified. Fig.* 8, a grain of pollen, *highly magnified. Fig.* 9, a longitudinal section of the stipitate ovary, showing two of its cells, each cell bearing, on the summit of the axile column, an anatropous ovule, with a ventral raphe. *Fig.* 10, a transverse section of the same, showing its five complete cells, each bearing a suspended ovule: *both magnified. Fig.* 11, an ovule with its ventral raphe, *more magnified.*

B. Details of Diclidanthera laurifolia.

Fig. 12, a mature fruit. *Fig.* 13, a transverse section of the same, containing a single suspended seed filling one of its cells, the other four cells being sterile. *Fig.* 14, the seed extracted, showing its pubescent testa. *Fig.* 15, a side view of the same. *Fig.* 16, a longitudinal section of the same. *Fig.* 17, the albumen, covered by the tegmen, with its basal chalaza, the testa having been removed. *Fig.* 18, a longitudinal section of the albumen, showing the enclosed embryo. *Fig.* 19, the same, cut crossways. *Fig.* 20, the embryo extracted, seen in front and edgeways: *all nat. size.* *Fig.* 21, the deciduous stipules, with their accompanying persistent glands.

PLATE 33.—A. Details of RHAMNUS CATHARTICUS.

Fig. 1, a drupe. *Fig.* 2, one of its three endocarpal nuts, seen edgeways. *Fig.* 3, the same, seen on the ventral face, showing its sutural line of dehiscence: *all nat. size.* *Fig.* 4, the same, in the act of its dehiscence, showing the enclosed erect seed, *magnified.* *Fig.* 5, the seed extracted, seen on its dorsal face, showing the longitudinal plicated channel. *Fig.* 6, the same, seen on the smooth ventral face of its external coriaceous tunic. *Fig.* 7, the same, seen on its dorsal face, with the external crustaceous tunic (*arillus*) removed. *Fig.* 8, the same, seen on the ventral face, after the removal of the external crustaceous tunic, showing the ventral line of raphe imbedded in this second membranaceous integument (*testa*), with the chalaza in the apical sinus. *Fig.* 9, the same, seen on the dorsal face (fig. 7), but opened out in order to show the more conspicuous dorsal line of raphe (before hidden in the groove) which proceeds from the chalaza in continuity with the line of raphe of the opposite face. *Fig.* 10 is a view of fig. 8, opened out in like manner, the ventral line of the raphe, with a portion of the second integument in which it is imbedded, having been torn away, leaving the chalaza, which is agglutinated to the second and third integuments, and showing the groove left in it by the removal of the line of raphe. *Fig.* 11, the continuous line of the ventral and dorsal raphe (as shown torn away in the preceding figure from the second integument, or membranaceous testa). *Fig.* 12, the embryo removed from the albumen, in its natural plicated form. *Fig.* 13, the same opened out. *Fig.* 14, the same, seen edgeways. *Fig.* 15, a transverse section of the seed, showing the external crustaceous arillus with its infolded plates, the two integuments (testa and tegmen) showing the separation that exists between them in the axis of the seed in the form of a square hollow space; the dorsal raphe is there seen imbedded in the testa, within the groove formed by the plicature of the seed, and the ventral raphe is shown on the contrary side concealed by the arillus. *Fig.* 16, a transverse section of the arillus removed, represented in its natural form of plicature. *Fig.* 17, a transverse section of the two proper integuments (testa and tegmen), in their natural form, with the vacant space existing between them in the axis, showing the relative position of the dorsal and ventral line of raphe. *Fig.* 18, a transverse section of the albumen and enclosed embryo, in their naturally plicated form. *Fig.* 19, a transverse section of the embryo extracted: *all equally magnified.* *Fig.* 20, longitudinal section of one of the cells of the ovary, with an erect anatropous ovule, supported on its long funicle, which is continuous with its dorsal raphe. *Fig.* 21, the same ovule removed, before its impregnation. *Fig.* 22, the same ovule after impregnation, with the arilliform outer coating grown over it, and enclosing the funicle: *all much magnified.*

B. Details of RHAMNUS CHLOROPHORUS.

Fig. 1, a drupe. *Fig.* 2, one of its endocarpal nuts, seen on its ventral face, showing the line of its dehiscence. *Fig.* 3, the same, seen sideways. *Fig.* 4, the enclosed seed: *all nat. size.* *Fig.* 5, a transverse section of one of the nuts, in the act of its dehiscence, with the enclosed seed, showing the position of its lateral chink and hilar scar in relation to the ventral line of dehiscence of the epicarp: *magnified*. *Fig*. 6, a seed, *more magnified*, covered with its shining crustaceous arillus, which is entire, except at the nearly lateral long umbilicated hilum. *Fig*. 7 is a side view of the same. *Fig*. 8 is a view of the contrary side, with the whole of the external crustaceous coating removed, showing the chalaza and the dextral line of raphe continuous with the main or sinistral cord of the raphe, hidden on the opposite side in the deep groove formed there by the hippocrepical plicature of the albumen. *Fig*. 9, the same, seen on one of its broad faces, showing the apical chalaza and the deep lateral groove formed by the said plicature. *Fig*. 10, the same view, the lax portion of the interplicated proper integuments, to which the sinistral or main cord of the raphe is attached, being drawn out by force from its natural position in the groove. *Fig*. 11, the plicated embryo, removed from the albumen, as seen in its natural form. *Fig*. 12, the same flattened out. *Fig*. 13, a transverse section of a seed, above the line of the umbilicated hilum, showing the following parts:—1. The outer crustaceous entire tunic or arillus, an open space always existing on the two opposite margins of the seed between it and the proper integument, where they do not touch each other; in these two open spaces the two cords of the raphe are found imbedded in the intermediate integument, showing that the continuous cord of the raphe has no connexion whatever with the external crustaceous shell, except at the point of its origin near the hilum, and proving that the crustaceous tunic is a true arillus, although crustaceous in its texture. 2. The two proper integuments of the seed (testa and tegmen), which are membranaceous, and closely applied to one another, except in the deep groove formed by the plicature of the albumen: here the tegmen, or inner integument, is extended over the whole surface of this plicature; the testa, however, scarcely enters into it, but passes over the mouth of the groove, leaving a long deep narrow open space between the two integuments, after the manner shown in *Rhamnus catharticus*; it is along the mouth of this groove, where the testa passes over it, that the main cord or sinistral line of raphe is seen imbedded in its tissues: this is also shown in fig. 10, where the two integuments with the cord of the raphe are forced out of their natural position. 3. The albumen closely invested by the integument, bent into a hippocrepical shape. 4. The embryo, partaking of the same form: *all equally magnified*. *Fig*. 14, an ovule at the period of impregnation, supported on its stipitated funicle, showing the commencement of the placentary development, which afterwards becomes extended over the ovule as an arillus, *much magnified*. *Fig*. 15, the same funicle and beginning of the placentary expansion, *more highly magnified*.

C. Details of Rhamnus Alaternus.

Fig. 1, a seed, seen upon its ventral face. *Fig*. 2, the same seen edgeways. *Fig*. 3, a view of the same on its dorsal face, where there is a longitudinal deep groove. *Fig*. 4, a transverse view of the same, showing the following parts:—1°, the external crustaceous shell or arillus, showing the dorsal groove formed by the interruption of its continuity; 2°, the two proper membranaceous integuments which closely invest the albumen, leaving a distinct vacuity between them and the outer crustaceous tunic, along the middle of the two faces, where the dorsal and ventral cords of the raphe are imbedded in the outer of the two integuments: here is a further proof of the nature and origin of the crustaceous coating; 3°, the albumen, distinctly curved; 4°, the enclosed embryo, partaking of the same curvature: *all magnified*. *Fig*. 5, longitudinal section of one of the cells of the ovary, showing its erect ovule, with a dorsal raphe supported on a long funicle. *Fig*. 6, the same ovule, showing the small protuberance in connexion with the placenta at the foot of the funicle which forms the growing-point of the future arillus. *Fig*. 7, the same, where the arilliform coating has grown over and concealed the primine and its funicular support, as shown in the previous species: *all highly magnified*.

D. Details of FRANGULA VULGARIS.

Fig. 1, a seed, *magnified*, covered by a hard crustaceous entire coating (an arillus), which has only a small pervious opening at the base, that being the point of its attachment to the placenta. *Fig.* 2, the same, seen sideways. *Fig.* 3, a longitudinal section of the same, showing that the outer crustaceous shell is quite free all round the circumference of the second membranaceous integument, except for a short space near the basal aperture on one side. *Fig.* 4, a view of the same, with the outer crustaceous coating removed: here is seen the simple cord of the raphe, which is quite peripheral, consisting of numerous spiral vessels imbedded in the integument, and which, in its course round the margin, crosses over the apical chalaza: one extremity of this raphe is lost in the small point of attachment of the integument to the arillus, the other passes out of the hilar aperture to communicate with the placenta. *Fig.* 5, a longitudinal section of the albumen, enclosing the embryo. *Fig.* 6, the embryo extracted, seen on one face. *Fig.* 7, the same, seen edgeways: *all equally magnified.*

E. Details of ZIZYPHUS SINENSIS.

Fig. 1, a ripe drupe. *Fig.* 2, a longitudinal section of the same, showing its enclosed fusiform nut. *Fig.* 3, the nut extracted. *Fig.* 4, a transverse section of the same bilocular osseous nut, each cell containing a single erect seed. *Fig.* 5, a longitudinal section of the same, with the seeds *in situ*: each seed is seated in a small cup with a crenulate margin. *Fig.* 6, the seed extracted, seen edgeways. *Fig.* 7, the same, seen on its face. *Fig.* 8, the same, seen from below, showing the small transverse chink in its base, which answers to a corresponding line in the bottom of the cup, indicating the point of its attachment. *Fig.* 9, the small cup which bears the seed, from which it is quite free, except on the small line of the chink: *all nat. size.* *Fig.* 10, a longitudinal section of the seed, *magnified*, showing the rather soft chartaceous outer tunic (evidently an arillus), which is quite free from the second membranaceous integument, there being a considerable vacant space between them; it is in the base of this outer tunic that we find the small basal chink above described. *Fig.* 11, the same, with the outer tunic removed, showing the second tunic, which is membranaceous and semitransparent; all round its marginal edge is seen one continuous peripheral cord of spiral vessels, both extremities meeting at the base, and in its course passing over the apical chalaza: this tunic is evidently the testa, because it contains the raphe, and through it is perceived the inner integument (or tegmen), which is somewhat smaller and more contracted towards the base, where it terminates in a filamentous neck, which is united there to the mouth of the testa. *Fig.* 12, the embryo, extracted from a very thin albumen. *Fig.* 13, the same, seen edgeways.

F. Details of ALPHITOBIA EXCELSA.

Fig. 1, a drupe. *Fig.* 2, its two endocarpal nuts extracted. *Fig.* 3, a nut seen edgeways. *Fig.* 4, the same, seen on its ventral face, showing its sutural line of dehiscence. *Fig.* 5, the endocarp bursting open, showing its enclosed seed. *Fig.* 6, the same, with the seed removed. *Fig.* 7, the seed extracted, seen on its ventral face. *Fig.* 8, the same, seen on its dorsal face: *all nat. size.* *Fig.* 9, the same, *magnified*, to show more distinctly the outer lax membranaceous tunic, with its edges imbricately folded over each other on the dorsal face, this fold being on the face contrary to the line of dehiscence of the epicarp. *Fig.* 10, the same, unfolded, showing the enclosed seed. *Fig.* 11, the same, with the seed removed; it is thicker at the base than at the more membranaceous margins: this appears like a second and more external arillus, and is analogous in its nature and origin to the small basal cup of the seed shown in *Zizyphus*: *all magnified*. *Fig.* 12, the seed removed (*more magnified*), seen on its ventral face; it is entire and chartaceous, as in *Zizyphus*, and, like it, has a small basal foraminal chink. *Fig.* 13, a longitudinal section of the same across the shorter diameter, showing the smaller enclosed nucleus, from which it is quite free all round; this nucleus is seen edgeways, with the peripheral line of raphe proceeding from the base and crossing the chalazal apex: the integument containing this raphe is therefore the true testa, although membranaceous; and the chartaceous covering appears to be another arillus, similar in its nature and origin to the crustaceous tunic of the seed in *Rhamnus*. *Fig.* 14, a longitudinal section of the same across the broader diameter, exhibiting the same parts; here the completely peripheral cord of the raphe is seen crossing over the chalaza. *Fig.* 15, a transverse section of the same, showing the same parts. *Fig.* 16, the embryo, extracted from the albumen. *Fig.* 17, the same, seen on its edge: *all equally magnified*. *Fig.* 18, an ovule before impregnation, seated in its cup-shaped fleshy support, from the growth of which, the outer lax or second arillus probably originates. *Fig.* 19, a longitudinal section of the same fleshy support, with the unimpregnated ovule seated on its funicle, previous to the development of the principal arillus or chartaceous integument.

PLATE 34.—A. COLLETIA SPINOSA.

Fig. 1, flower before and after expansion. *Fig.* 2, flower cut open: *both nat. size*. *Fig.* 3, calyx, *magnified*, showing its annular perigynous disk, and the stamens seated between the teeth, as well as its pistil. *Fig.* 4, stamens before and after dehiscence, seen in different positions, *more magnified*.

B. COLLETIA INTRICATA.

Fig. 1, a flower, *nat. size*. *Fig.* 2, the same, *magnified*. *Fig.* 3, the same cut open. *Fig.* 4, the stamens before and after dehiscence, seen in different positions: *all magnified*.

C. COLLETIA FEROX.

Fig. 1, a flower, *nat. size*. *Fig.* 2, the same cut open, *magnified*.

D. COLLETIA ATROX.

Fig. 1, a flower, *nat. size*. *Fig.* 2, the same, *magnified*. *Fig.* 3, the same cut open, *also magnified*.

E. COLLETIA CRUCIATA.

Fig. 1, a flower, *nat. size*. *Fig.* 2, the same cut open, *magnified*. *Fig.* 3, the stamens before and after dehiscence, seen in different positions, *more magnified*.

F. COLLETIA WEDDELLIANA.

Fig. 1, a flower, *nat. size*. *Fig.* 2, the calyx fallen away from its basal portion and cut open. *Fig.* 3, the pistil, enclosed in the circumscissed cup of the calyx: *both magnified*.

PLATE 35.—A. COLLETIA KUNTHIANA.

A portion of a branch, *nat. size*.

B. Colletia tenuicula.

Fig. 1, a flower before and after expansion, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open, *also magnified.*

C. Colletia pungens.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open, *also magnified.* *Fig.* 4, the stamens before dehiscence. *Fig.* 5, the same after dehiscence: *both more magnified.*

D. Colletia Spartioides.

Fig. 1, a flower cut open, *magnified.* *Fig.* 2, an anther before dehiscence, seen in front. *Fig.* 3, the same after dehiscence, seen in different positions: *both more magnified.*

E. Colletia cataphracta.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, a longitudinal section of the same, *also magnified.* *Fig.* 4, stamens before dehiscence. *Fig.* 5, the same after dehiscence: *both more magnified.*

F. Colletia armata.

Fig. 1, a flower, *magnified.* *Fig.* 2, the same cut open, *also magnified.* *Fig.* 3. the stamens before dehiscence, seen in different positions. *Fig.* 4, the pistil: *both more magnified.*

Plate 36.—A. Colletia dumosa.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open, *also magnified.* *Fig.* 4, a stamen before and after dehiscence, *more magnified.* *Fig.* 5, a grain of pollen, *highly magnified.* *Fig.* 6, the pistil, *magnified.* *Fig.* 7, a 3-lobular capsule, seated in the circumscissed persistent cup of the calyx. *Fig.* 8, the three endocarpal cells, with and without the enclosed seed, showing the manner of their dehiscence along the axile suture. *Fig.* 9, the persistent cup of the calyx, out of which the endocarpal cells have been thrown by the elastic force of their dehiscence. *Fig.* 10, the seeds: *all nat. size.* *Fig.* 11, the same, seen in front, *magnified.* *Fig.* 12, the same, shown edgeways, where the basal chink is observed. *Fig.* 13, the same, seen from below, to show the basal chink. *Fig.* 14, the same, seen in front, with half of the outer crustaceous tunic removed: it is along the line so cut away, and in the intermediate integument there shown, that we may perceive the peripheral cord of the raphe, which, originating in the basal chink, passes all round, crossing the apical chalaza, and returns to the point of its origin. *Fig.* 15, a longitudinal section of the intermediate integument, showing the inner integument entire, with its apical chalaza, and contracted at its base into a conical shape. *Fig.* 16, the peripheral cord of the raphe removed. *Fig.* 17, the inner integument removed. *Fig.* 18, the albumen. *Fig.* 19, a longitudinal section of the same across its smaller diameter, showing the enclosed embryo. *Fig.* 20, the embryo removed, seen in front. *Fig.* 21, the same, seen sideways: *all equally magnified.*

B. Colletia Veprecula.

Fig. 1, a leaf, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, a flower, *nat. size.* *Fig.* 4, the same, *magnified.* *Fig.* 5, the calyx cut open. *Fig.* 6, the pistil: *all magnified.* *Fig.* 7, stamens before and after dehiscence, seen in different positions, *more magnified.*

C. Colletia aciculata.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same cut open, *magnified.* *Fig.* 3, a stamen, seen in front and sideways, *more magnified.*

D. Colletia hystrix.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the calyx cut open. *Fig.* 4, the pistil: *both equally magnified.*

E. Colletia ulicina.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same cut open, "*a*" showing the line of its circumscission when it falls away, the lower portion remaining persistent about the fruit. *Fig.* 3, stamens before and after dehiscence, seen in different positions. *Fig.* 4, the pistil: *all more or less magnified.*

Plate 37.—A. Notophæna serratifolia.

B. Notophæna foliosa.

Fig. 1, an axillary node, showing the stipules, and the mode of insertion of the petioles of the leaves, and also the inflorescence, *magnified.* *Fig.* 2, a flower, *magnified.* *Fig.* 3, the same, with half the calyx cut away, to show the pistil and the mode of insertion of the stamens. *Fig.* 4, stamens before dehiscence, seen before and behind. *Fig.* 5, the same after dehiscence. *Fig.* 6, the pistil: *all more or less magnified.* *Fig.* 7, fruit, *nat. size.*

C. Notophæna cognata.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same, with half the calyx cut away. *Fig.* 4, stamens, seen in different positions. *Fig.* 5, pistil: *all more or less magnified.*

D. Notophæna Magellanica.

Fig. 1, an axillary node, showing the stipules, insertion of petioles of leaves, and inflorescence, *magnified.* *Fig.* 2, a flower, *nat. size.* *Fig.* 3, the same, *magnified.* *Fig.* 4, the same, with half the calyx removed, to show the pistil seated in its disk, and the mode of insertion of the stamens. *Fig.* 5, stamens, seen in different positions, before and after dehiscence: *all more or less magnified.*

E. Notophæna Andina.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same cut open, *magnified.* *Fig.* 3, stamens before and after dehiscence, shown in different positions, *more magnified.*

F. Notophæna Toumatou.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open. *Fig.* 4, stamens before and after dehiscence: *all more or less magnified.*

Plate 38.—A. Discaria Americana.

Fig. 1, capsular fruit burst open, *nat. size.* *Fig.* 2, the same, *magnified.*

B. DISCARIA LYCIOIDES.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same, with half of the calyx cut away, to show the pistil seated in the disk, and the mode of insertion of the petals and stamens. *Fig.* 4, petal and stamen, seen in front and sideways. *Fig.* 5, a stamen, hind view. *Fig.* 6, the same, seen in front after dehiscence. *Fig.* 7, a petal: *all more or less magnified.*

C. DISCARIA LYCIOIDES var. *exilis.*

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same cut open, *magnified.* *Fig.* 3, a petal and stamen. *Fig.* 4, a petal. *Fig.* 5, a stamen. *Fig.* 6, the pistil seated in the disk, with a portion of the calyx. *Fig.* 7, the style and stigma: *all more or less magnified.*

D. DISCARIA LONGISPINA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same cut open, *magnified.* *Fig.* 3, a petal, seen in front and sideways. *Fig.* 4, a petal and stamen, seen in front and sideways. *Fig.* 5, a stamen, seen in front and sideways. *Fig.* 6, an anther after dehiscence. *Fig.* 7, a transverse section of the same. *Fig.* 8, a longitudinal section of the ovary, disk, and part of calyx: *all more or less magnified.*

E. DISCARIA SPICULATA.

Fig. 1, a flower cut open, *magnified.* *Fig.* 2, petal and stamen. *Fig.* 3, a petal, seen in front and sideways. *Fig.* 4, a stamen, front and hind view. *Fig.* 5, transverse section of an anther. *Fig.* 6, an axillary node, to show the stipules: *all more or less magnified.*

F. DISCARIA SPICULATA var. *gracilenta.*

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open, *also magnified.* *Fig.* 4, petal and stamen, front and side view, *more magnified.* *Fig.* 5, leaves. *Fig.* 6, an axillary node, to show the stipules: *both magnified.*

PLATE 39.—A. OCHETOPHILA TRINERVIS.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same, with half of the calyx removed, to show the pistil situated in the disk, and the position of the petals and stamens, *magnified.* *Fig.* 4, a petal and stamen. *Fig.* 5, a petal. *Fig.* 6, a stamen, seen in front and behind. *Fig.* 7, the same after dehiscence: *all more magnified.* *Fig.* 8, capsular fruit, *nat. size.* *Fig.* 9, the same, *magnified.* *Fig.* 10, one of the 3-coccous carpels removed from their capsular support, seen from the axis and laterally. *Fig.* 11, the same, showing the mode of bursting of the coccus: *all magnified.* *Fig.* 12, a seed, *nat. size.* *Fig.* 12*, the same, *magnified.*

B. OCHETOPHILA PROSTRATA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open, *also magnified.* *Fig.* 4, a petal and stamen, seen in front and sideways. *Fig.* 5, a stamen, seen before and behind. *Fig.* 6, a front and side view of the same after dehiscence. *Fig.* 7, the pistil seated in its cupular disk, with a portion of the calyx. *Fig.* 8, two nodes of a branchlet, showing the form and mode of insertion of its minute leaves and stipules: *all much magnified.*

C. OCHETOPHILA PARVIFOLIA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open. *Fig.* 4, petal and stamen, front and side view. *Fig.* 5, a front and side view of petal. *Fig.* 6, the pistil seated in the disk, with portion of the calyx on the line of its circumscission. *Fig.* 7, a node of a young branchlet, showing the mode of insertion of the minute leaves and stipules: *all more or less magnified.*

D. RETAMILIA EPHEDRA.

Fig. 1, a flower, with half of the calyx removed, *magnified.* *Fig.* 2, one of the teeth of the calyx, to show the apical gland and carinal nervure. *Fig.* 3, front and side view of a stamen before and after dehiscence: *all more magnified.*

E. RETAMILIA STRICTA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same cut open, *magnified.* *Fig.* 3, a petal and stamen. *Fig.* 4, a stamen, side and back view. *Fig.* 5, the same after dehiscence, front and side view. *Fig.* 6, a longitudinal section of the pistil: *all more or less magnified.* *Fig.* 7, transverse section of a fruit. *Fig.* 8, seed, seen front and sideways. *Fig.* 9, the same, seen from the base, to show the hilar chink: *all nat. size.*

F. DISCARIA ARTICULATA.

This plant, by mistake, is described in p. 289, under the name of *Retamilia articulata*, the error not being detected till after it was sent to press: it ought to follow the enumeration in p. 279.—*Fig.* 1, a flower cut open, *magnified.* *Fig.* 2, a petal and stamen seen in front. *Fig.* 3, a petal seen sideways and in front. *Fig.* 4, a stamen seen sideways. *Fig.* 5, the same after dehiscence: *all more magnified.*

PLATE 40.—A. TREVOA TRINERVIS.

Fig. 1, a flower, *magnified.* *Fig.* 2, the same, with half the calyx cut away, to show the enclosed pistil, and the position of the petals and stamens. *Fig.* 3, petal and stamen, seen in front. *Fig.* 4, a side view of the same. *Fig.* 5, a stamen seen in three different positions. *Fig.* 6, a front and side view of the same, after dehiscence. *Fig.* 7, a longitudinal section of the pistil: *all more or less magnified.* *Fig.* 8, a ripe drupe, *nat. size.* *Fig.* 9, a transverse section of the same, showing two cells. *Fig.* 10, a seed: *all nat. size.* *Fig.* 11, the same, front view, *magnified.* *Fig.* 12, a side view of the same. *Fig.* 13, basal view of the same, showing its hilar chink. *Fig.* 14, the same, with half of the crustaceous outer integument removed, to show the second integument. *Fig.* 15, the same, with half the second tunic removed, to show the third integument or tegmen, its apical chalaza, and basal constriction. *Fig.* 16, the peripheral cord of the raphe removed from the second fleshy integument. *Fig.* 17, the tegmen removed. *Fig.* 18, the albumen. *Fig.* 19, transverse section of the same, showing the enclosed embryo. *Fig.* 20, a longitudinal section of the same. *Fig.* 21, the embryo, seen in front. *Fig.* 22, a side view of the same: *all equally magnified.*

B. TREVOA TENUIS.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open, showing the line of circumscission round the base of the calyx, with the included pistil, and the position of the petals and stamens: *both magnified.* *Fig.* 4, a petal and included stamen, front and side view. *Fig.* 5, stamen before dehiscence, side and front view. *Fig.* 6, the same after dehiscence. *Fig.* 7, longitudinal section of the pistil: *all more or less magnified.* *Fig.* 8, a ripe drupe. *Fig.* 9, transverse section of the same, showing its three cells: *both nat. size.*

C. TREVOA BERTEROANA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, calyx above the line of its circumscission, cut open to show the position of the petals and stamens. *Fig.* 3, a drupe, supported by the persistent cupuliform base of the calyx: *both magnified.*

D. TREVOA WEDDELLIANA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same cut open, *magnified.* *Fig.* 3, a front and side view of petal. *Fig.* 4, a front and hind view of stamen: *both more magnified.*

PLATE 41.—A. TREVOA CLOSIANA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open. *Fig.* 4, front and side view of petal and stamen. *Fig.* 5, a stamen before dehiscence. *Fig.* 6, the same, opening. *Fig.* 7, the same after dehiscence, front and side view: *all more or less magnified.* *Fig.* 8, leaves, *nat. size.* *Fig.* 9, the same, *magnified.* *Fig.* 10, a node of a branchlet, showing the mode of insertion of the petioles of the leaves on the stipules, *magnified.*

B. TALGUENEA MOLLIS.

C. TALGUENEA COSTATA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, a petal and stamen seen in front. *Fig.* 4, a stamen seen in front. *Fig.* 5, the same after dehiscence. *Fig.* 6, hind view of the same. *Fig.* 7, side view of the same. *Fig.* 8, pistil. *Fig.* 9, longitudinal section of ovary. *Fig.* 10, transverse section of the same: *all more or less magnified.* *Fig.* 11, indehiscent membranaceous carcerule, enclosed in the persistent calyx. *Fig.* 12, the same, with the calyx removed. *Fig.* 13, seed, front and side view: *all nat. size.* *Fig.* 14, front and side view of the same, *magnified.* *Fig.* 15, longitudinal section of the same. *Fig.* 16, the third integument, with its apical chalaza. *Fig.* 17, longitudinal section of albumen, with the embryo enclosed. *Fig.* 18, front and side view of embryo: *all equally magnified.*

PLATE 42.—A. SCYPHARIA GUAYAQUILENSIS.

Fig. 1, an axillary node, showing the two opposite leaves, *magnified.*

B. SCYPHARIA PARVIFLORA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open, *also magnified.* *Fig.* 4, petal and stamen before dehiscence, side view. *Fig.* 5, front view of the same after dehiscence of anther. *Fig.* 6, the pistil, with portion of the calyx: *all more magnified.*

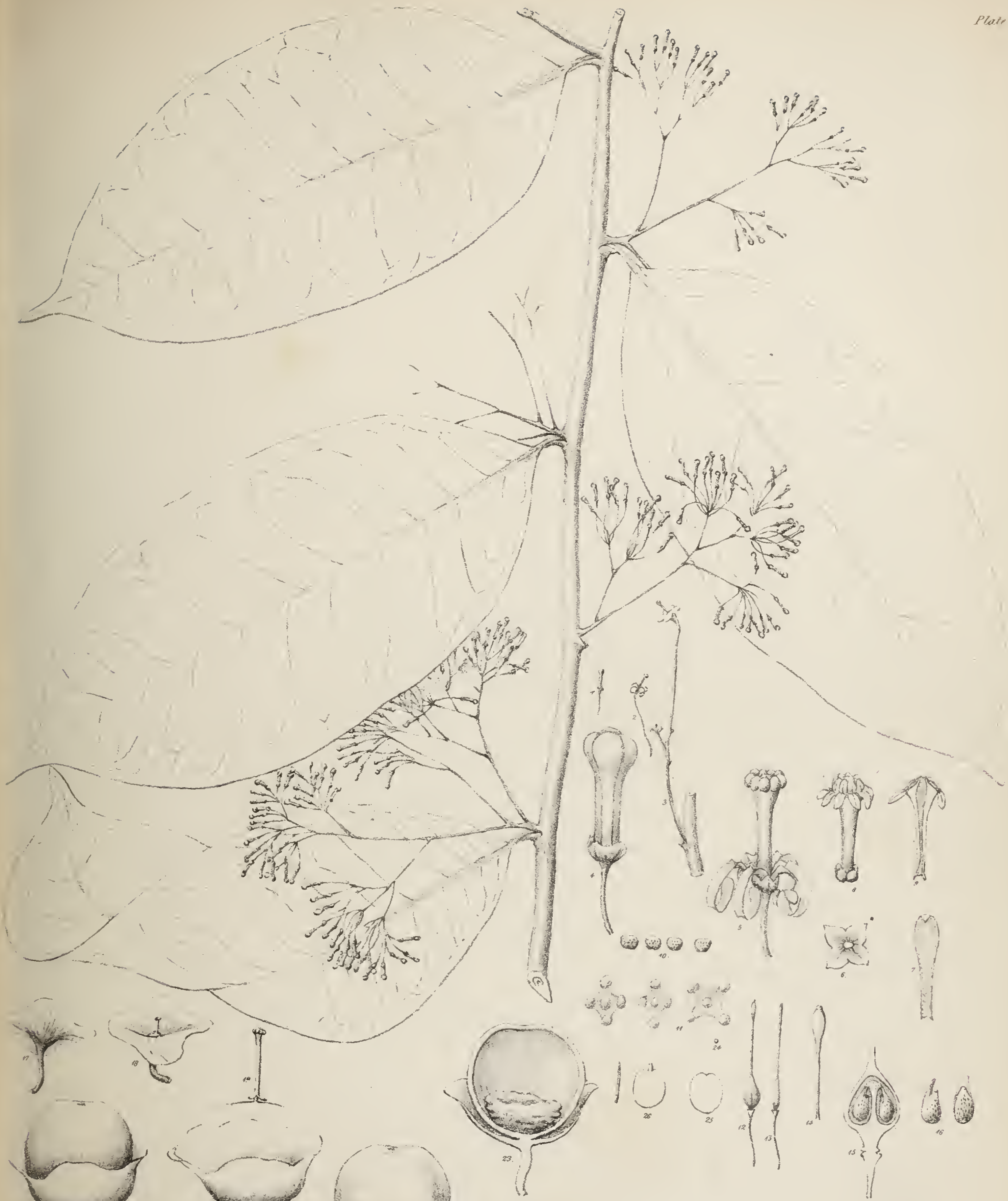
C. SCYPHARIA SENTICOSA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same cut open *Fig.* 4, a petal seen sideways. *Fig.* 5, the same seen in front, with its included stamen when erect, and after its deflexion: *all more magnified.*

D. SCYPHARIA? TETRAGONA.

Fig. 1, persistent calyx. *Fig.* 2, longitudinal section of the same: *both magnified.*

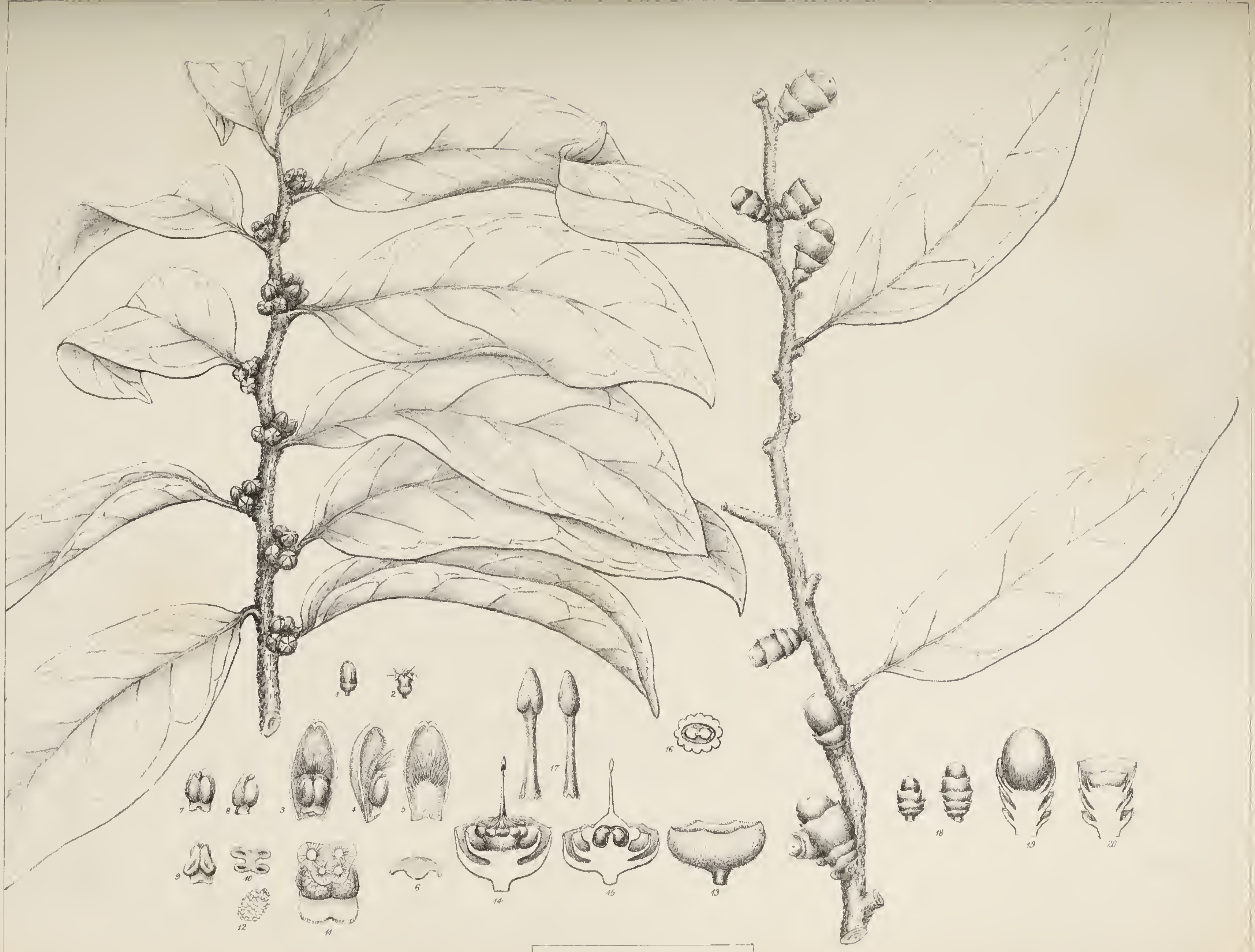
Plate I.



J. Miers del.

Hullmandel & Walton lith.

APTANDRA SPRUCEANA



details of C. rubricaulis

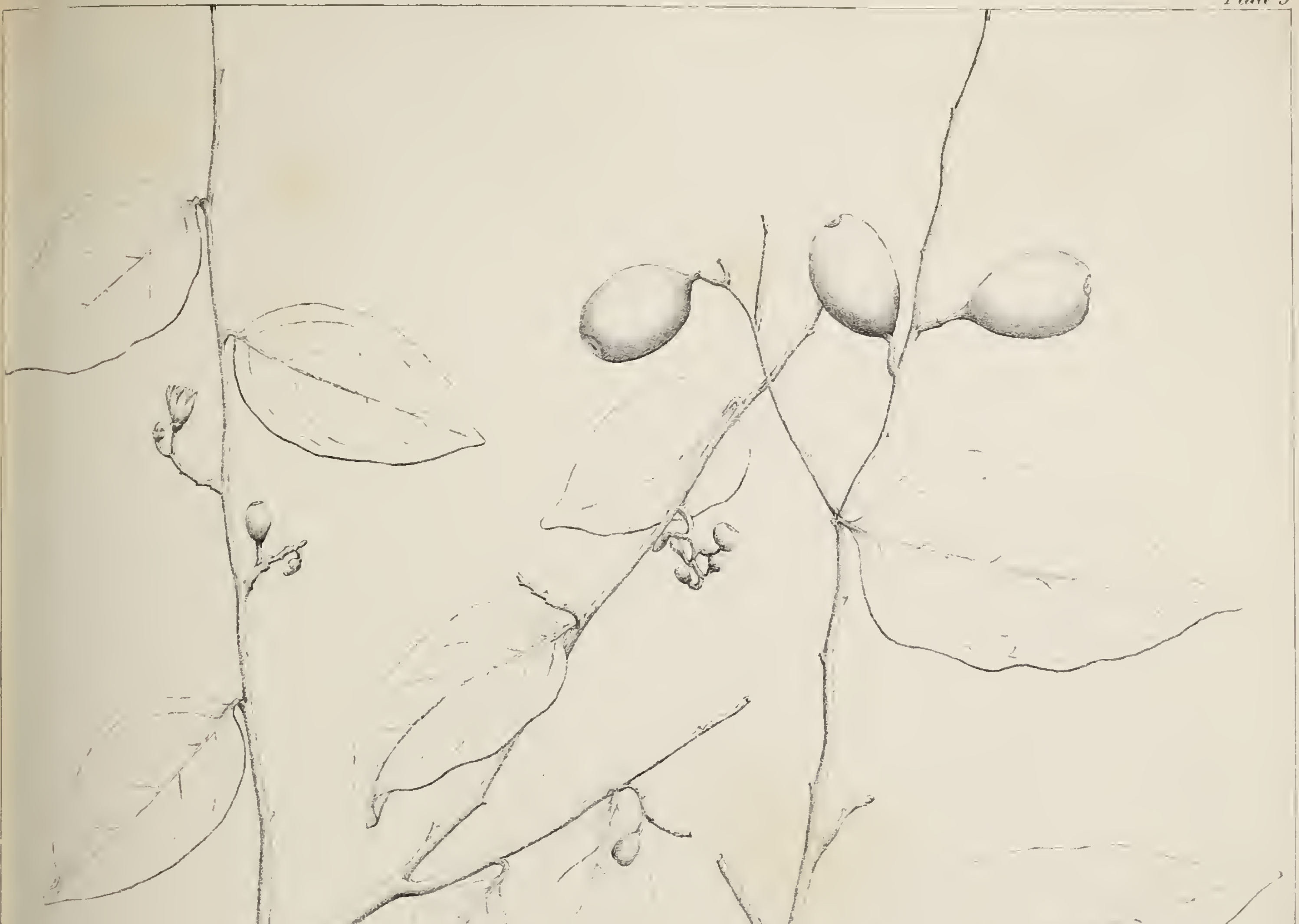
CATHEDRA.

details of C. Gardneri

J. Miers del.

Hullmandel & Walton lith.

Plate 3



L. VELLOZII

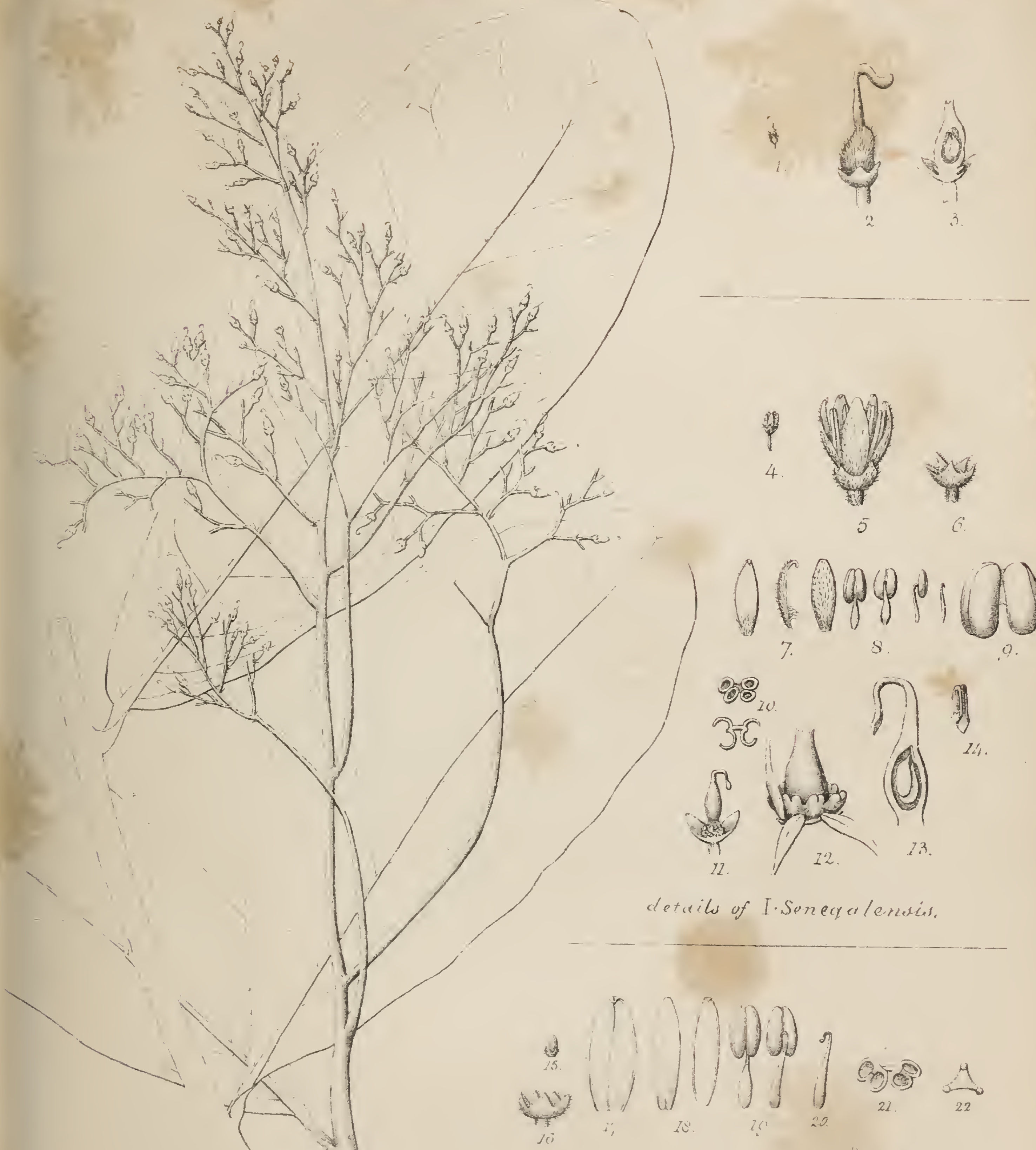
LIRIOSMA

L. GARDNERIANA

J Miers del

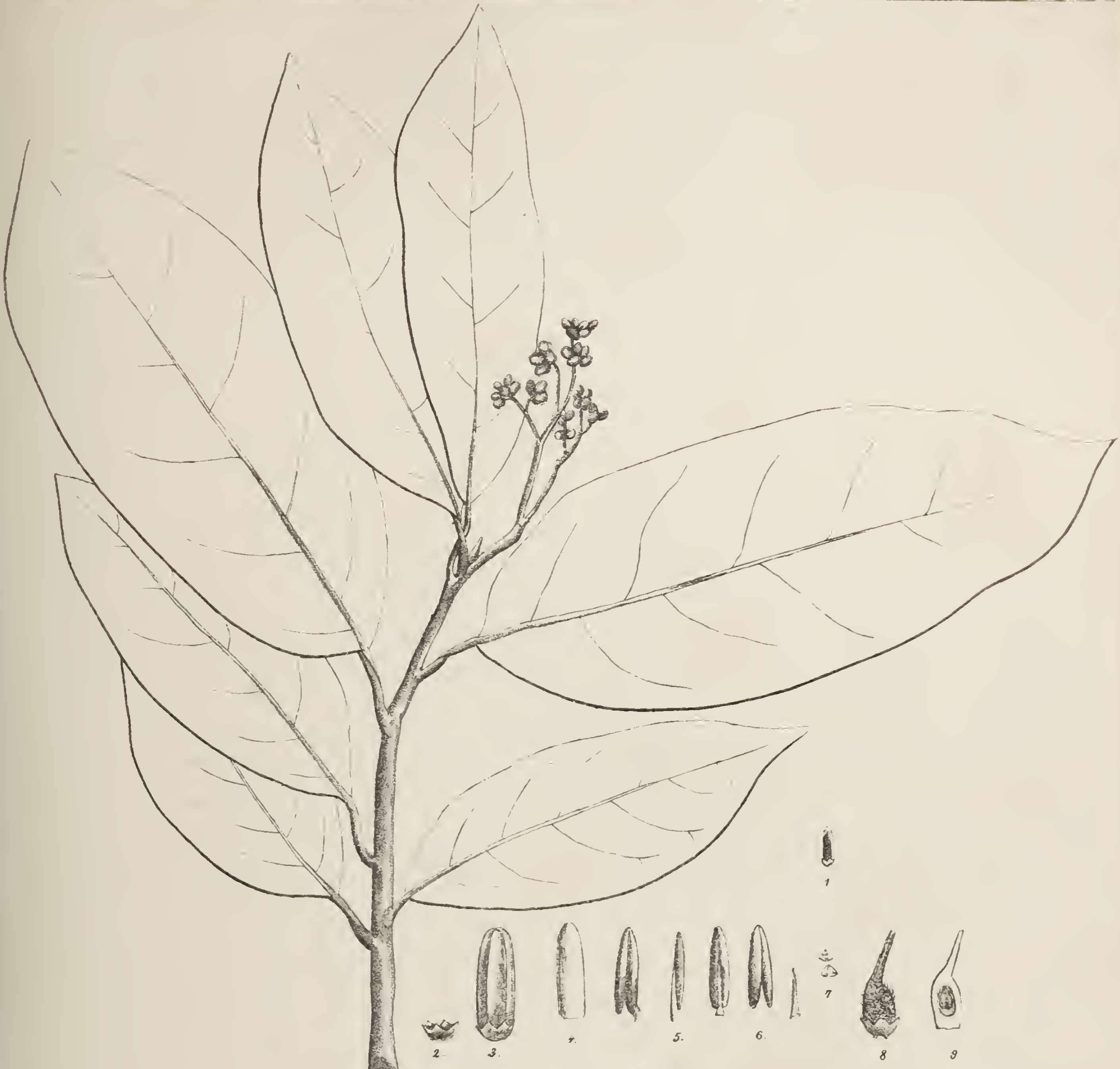
Hullmandel & Walton lith

Plate 4.

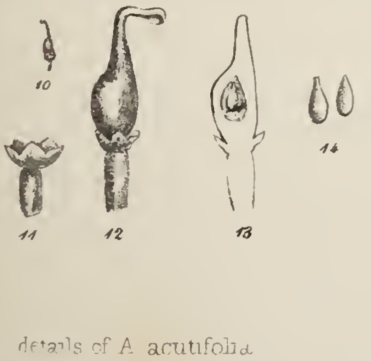


J Miers del.

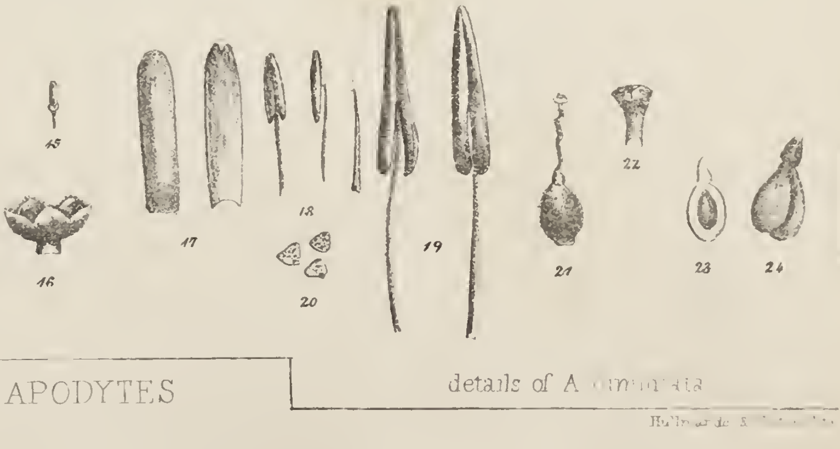
Icacina grandifolia.



A. GARDNERIANA



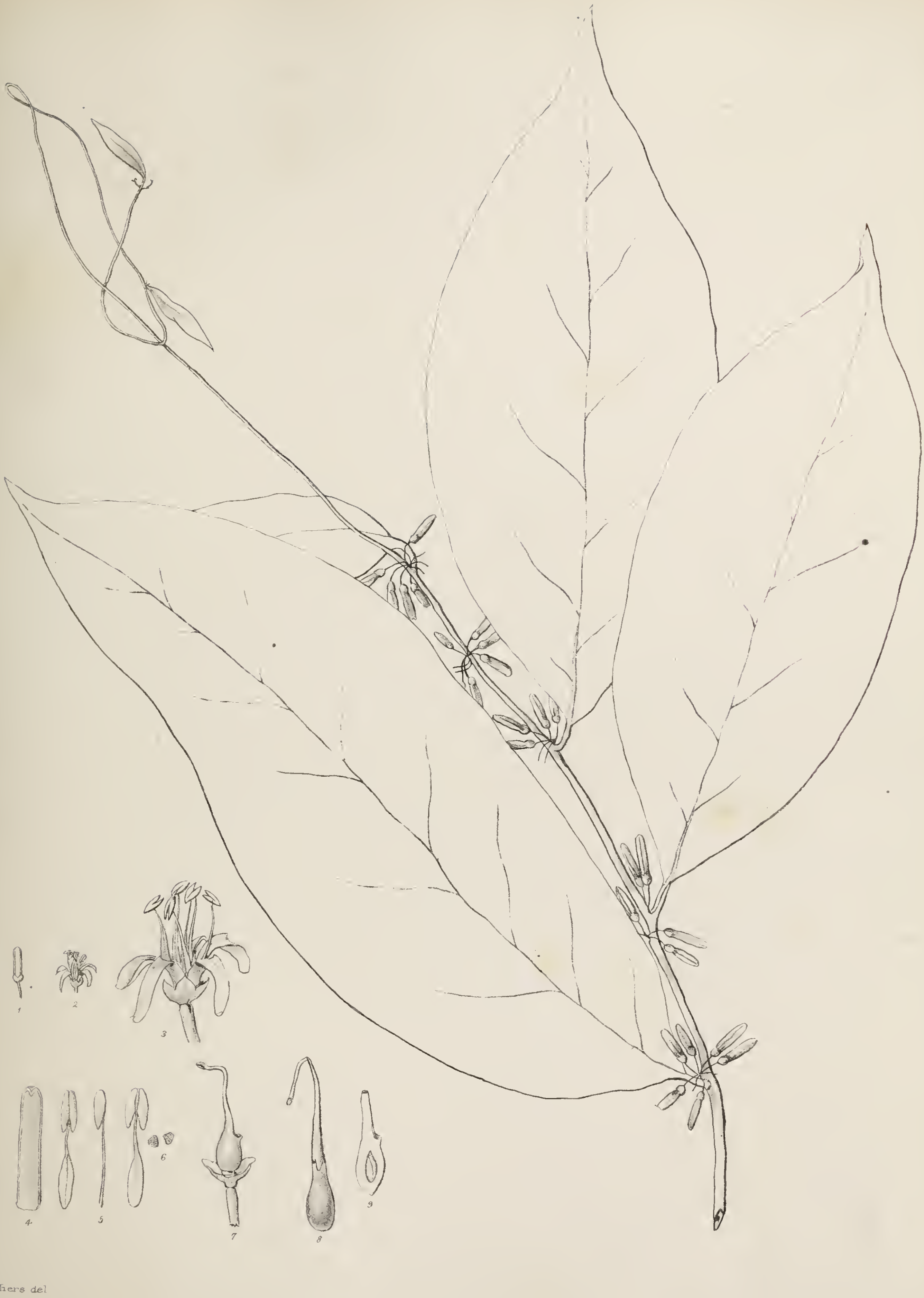
details of A. acutifolia



details of A. dimidiata

APODYTES

Hullmandel &

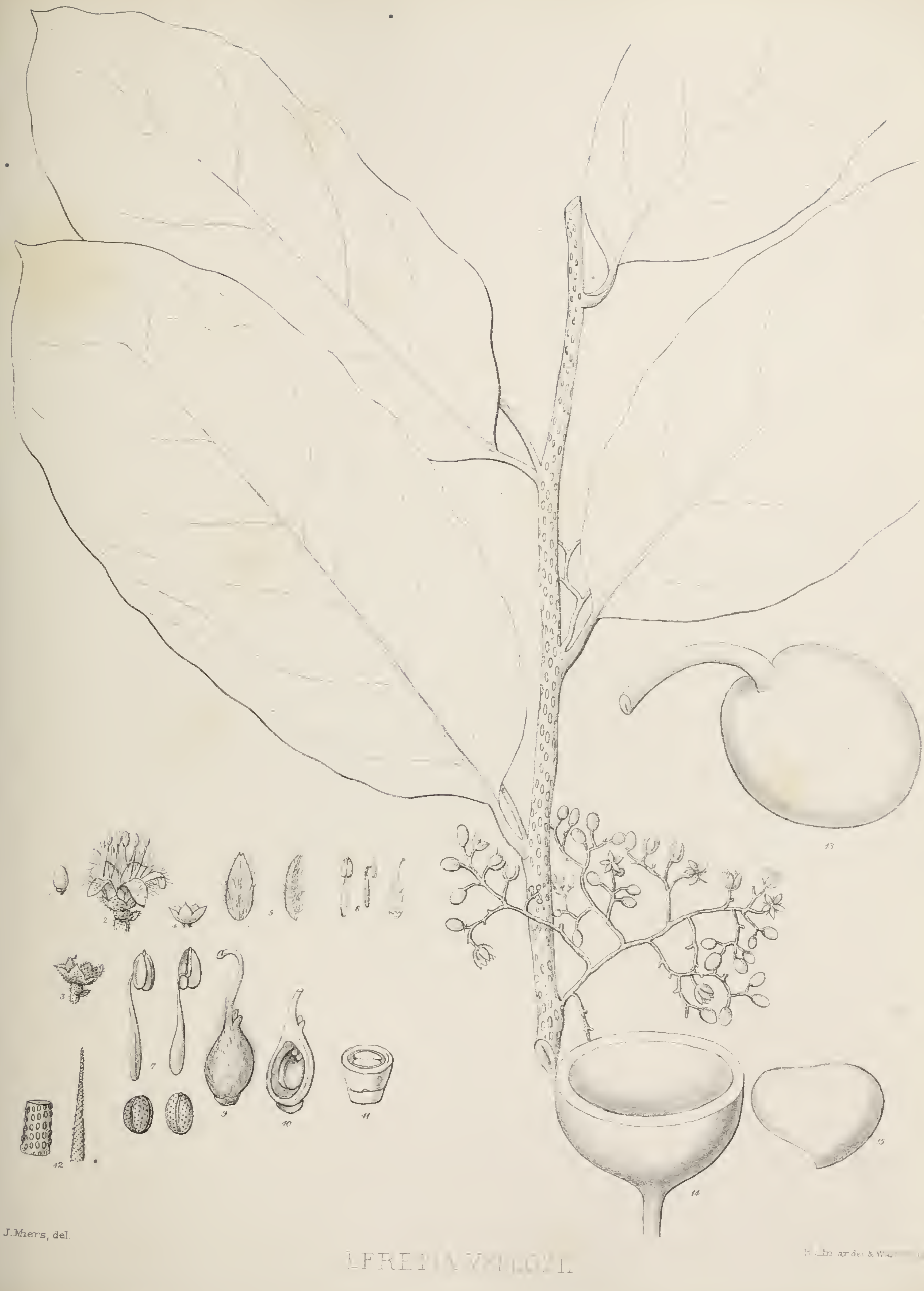


J Miers del

Hullmandel & Walton, lith

RHAPHIOSTYLES HEUDELOTII

Plate –



J. Miers, del.

LERETIA VELLOZII.

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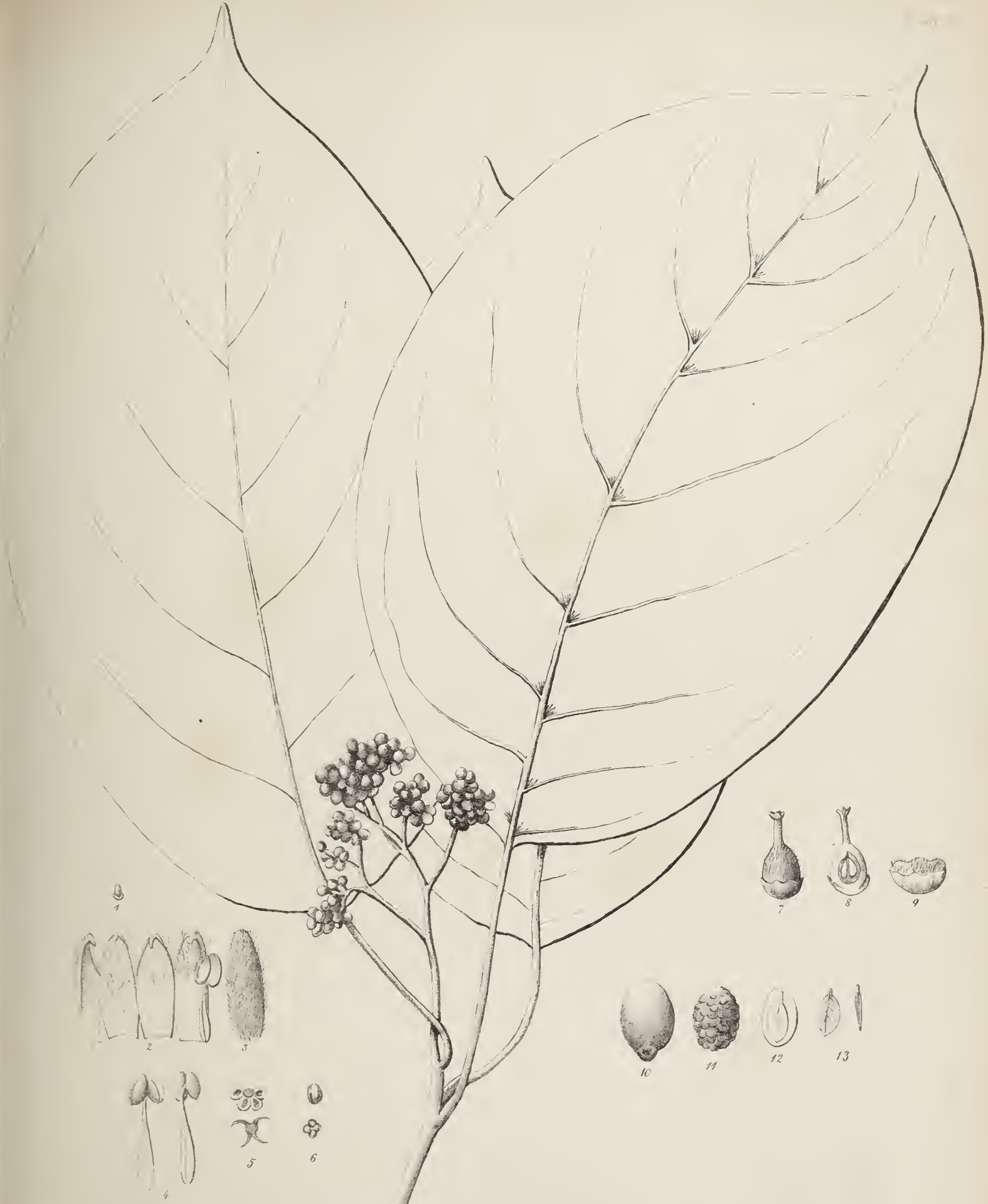

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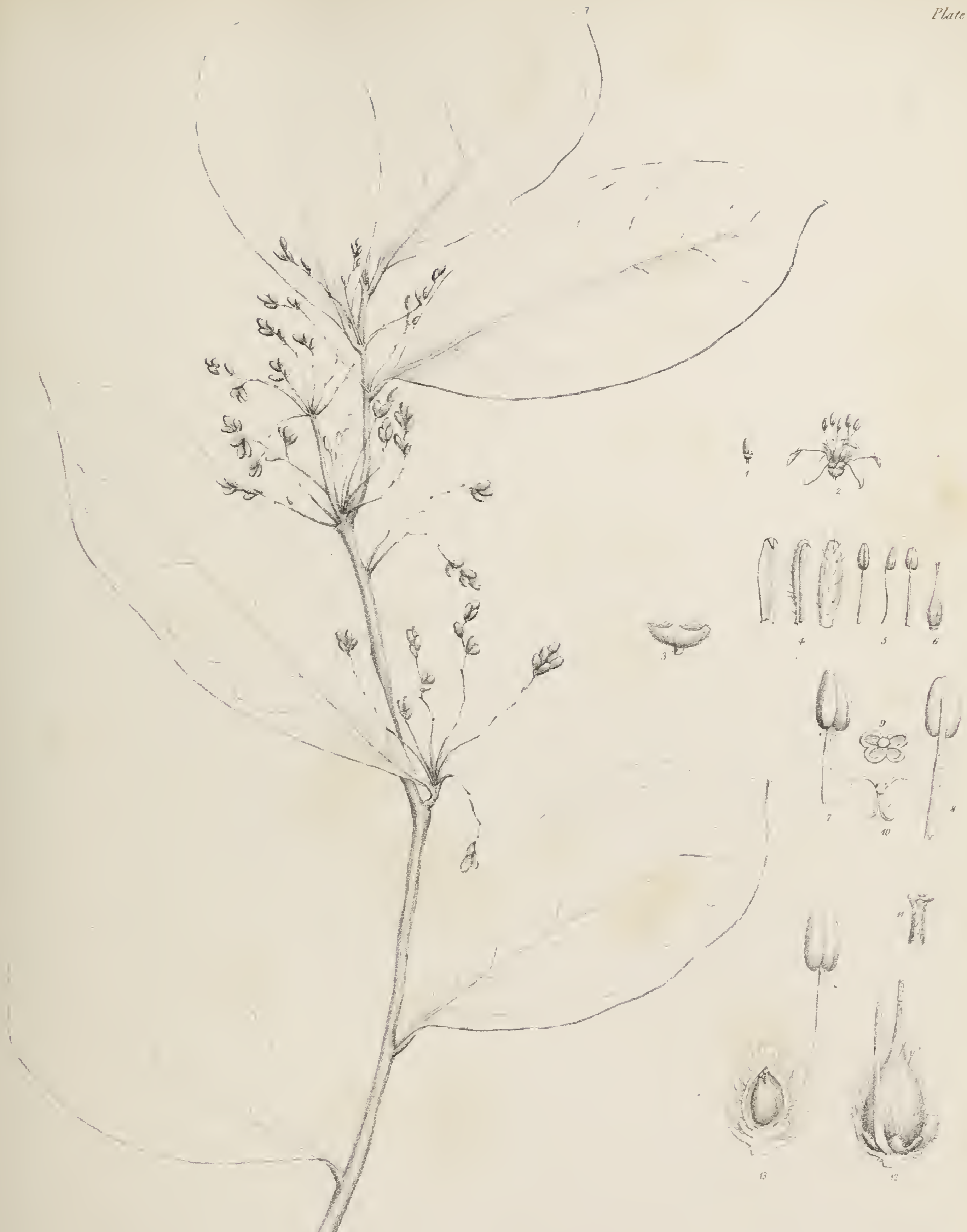
MAPPIA OVATA



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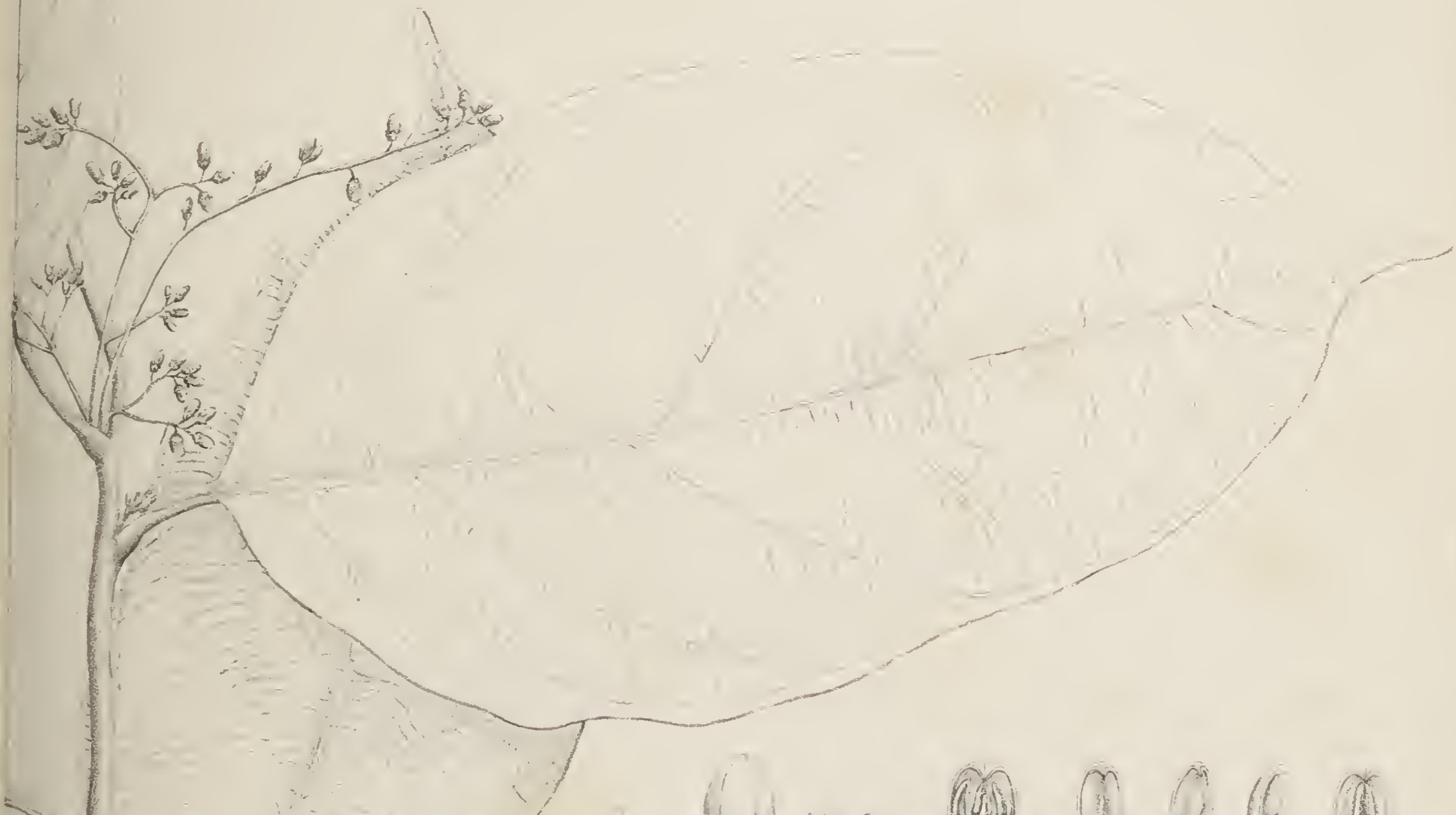
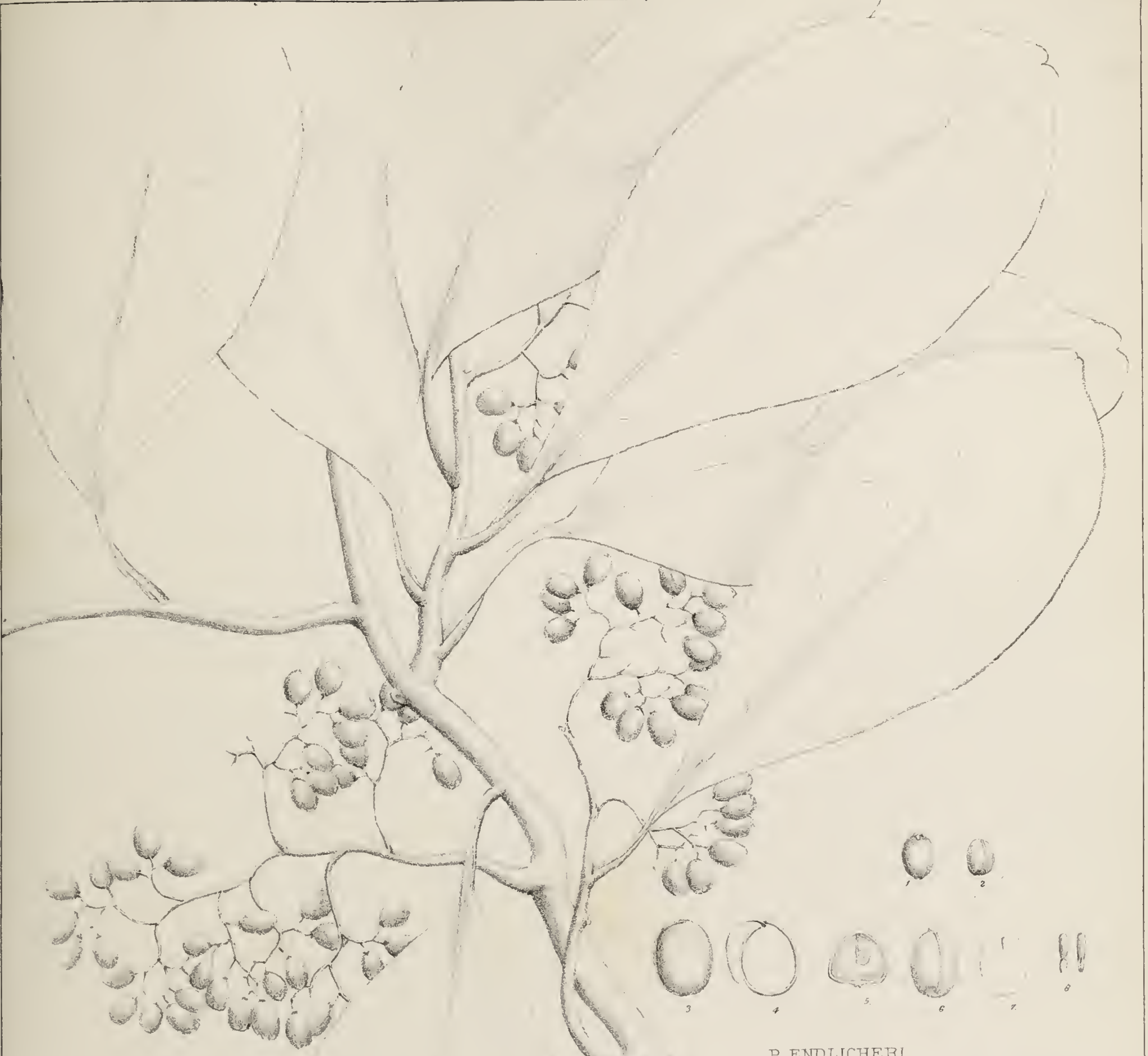
DESMOSTACHYS PLANCHONIANUS



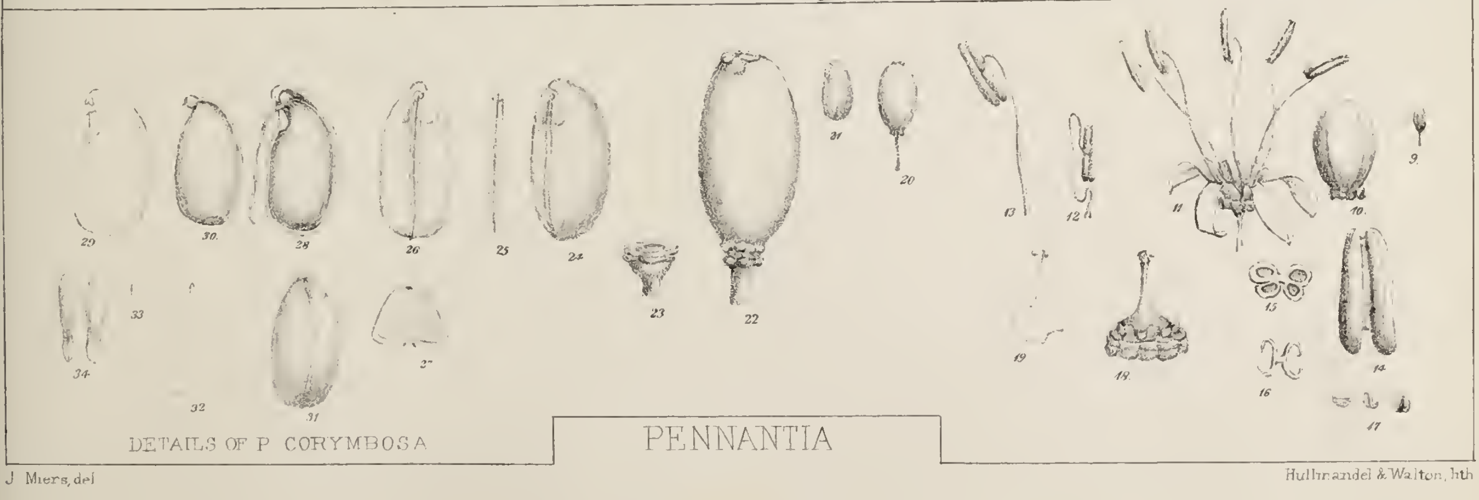
PORAQUEIBA SURINAMENSIS

J Miers, del.

Hullmandel & Walton lith



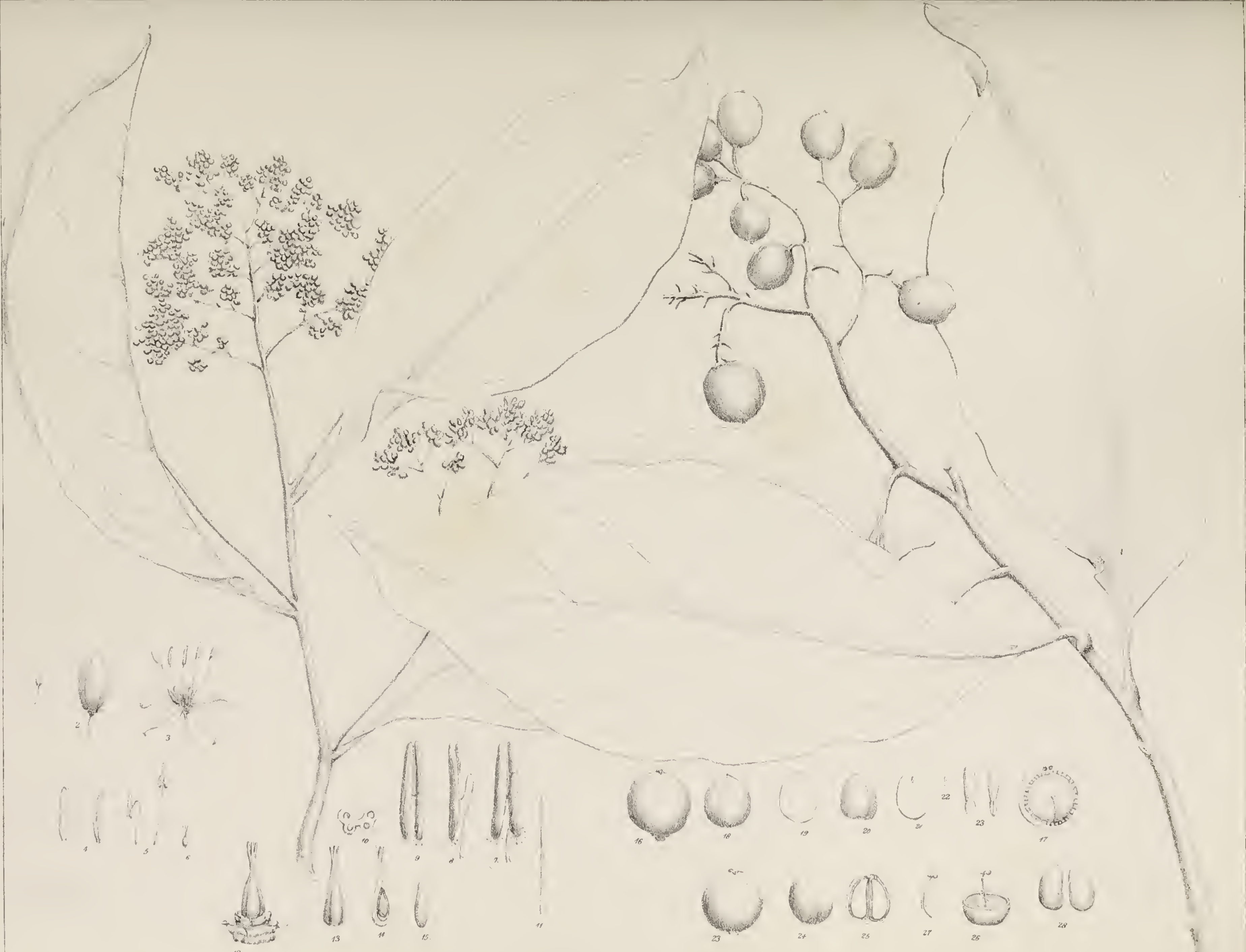
P. ENDLICHERI



DETAILS OF P CORYMBOSA

PENNANTIA

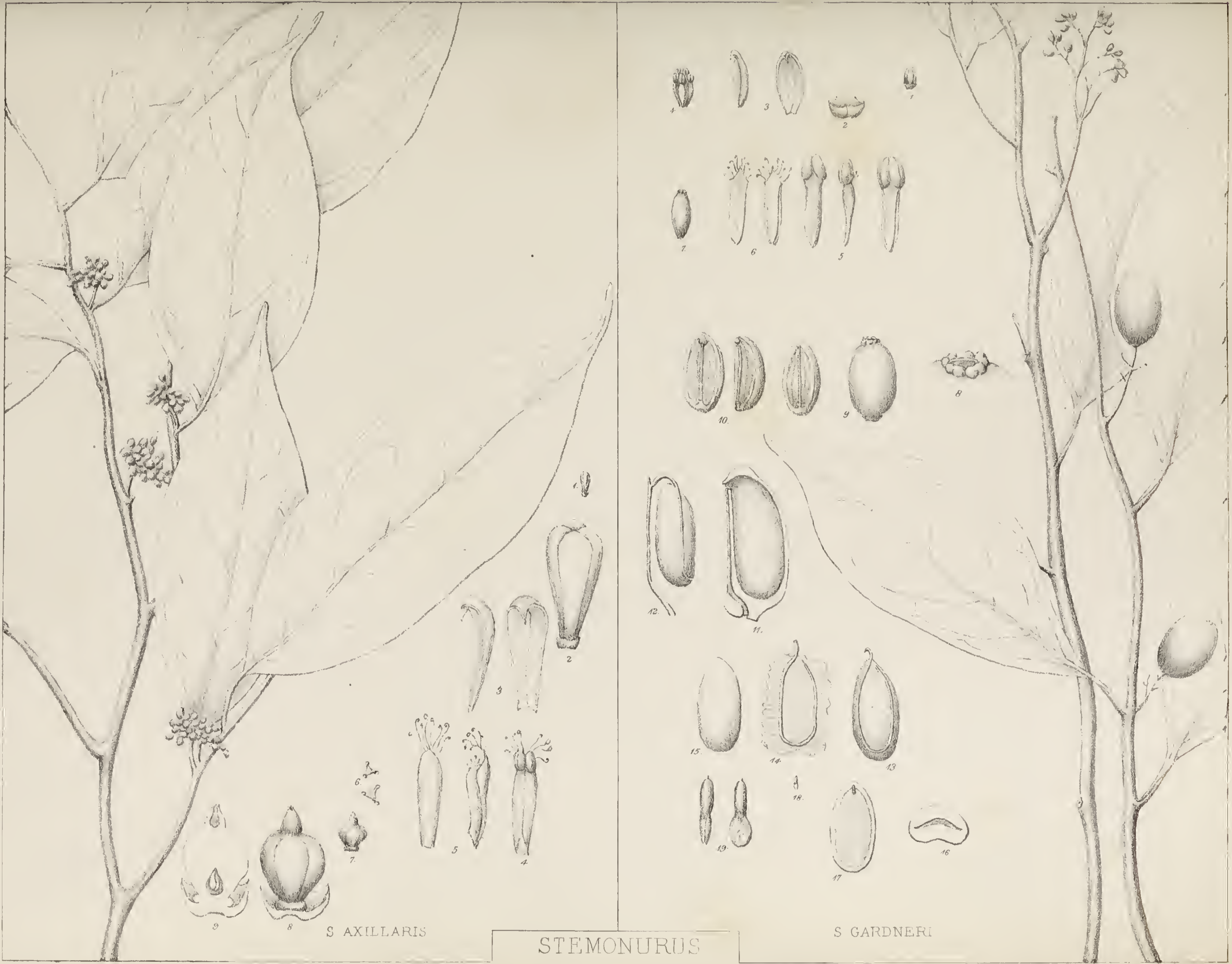
J Miers, del
Hullmandel & Walton, lith



PENNANTIA CUNNINGHAMI

J. Miers, del.

Hullmandel & Walton, lith.



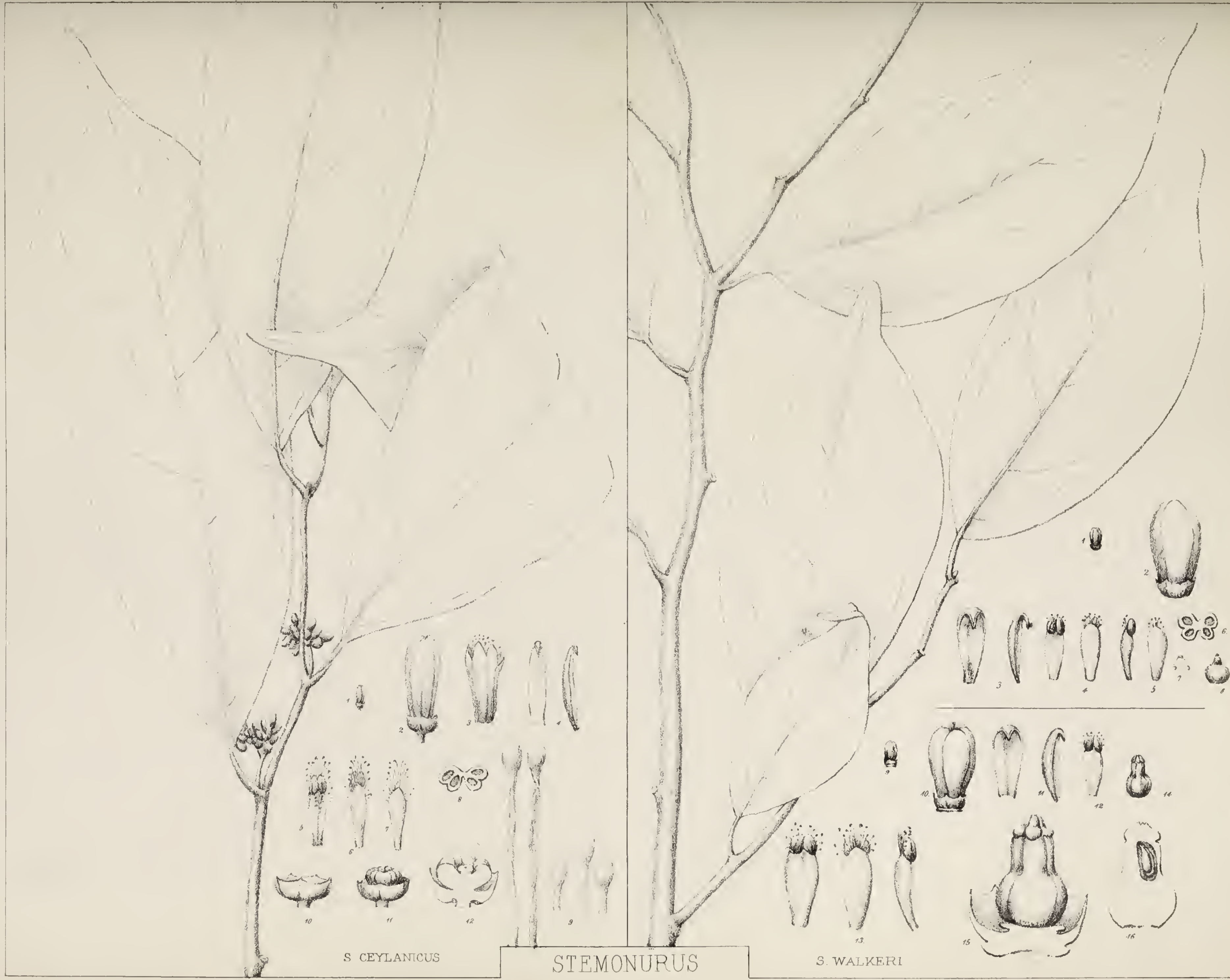
S AXILLARIS

S GARDNERI

STEMONURUS

J Miers del

Hullmandel & Walton lith



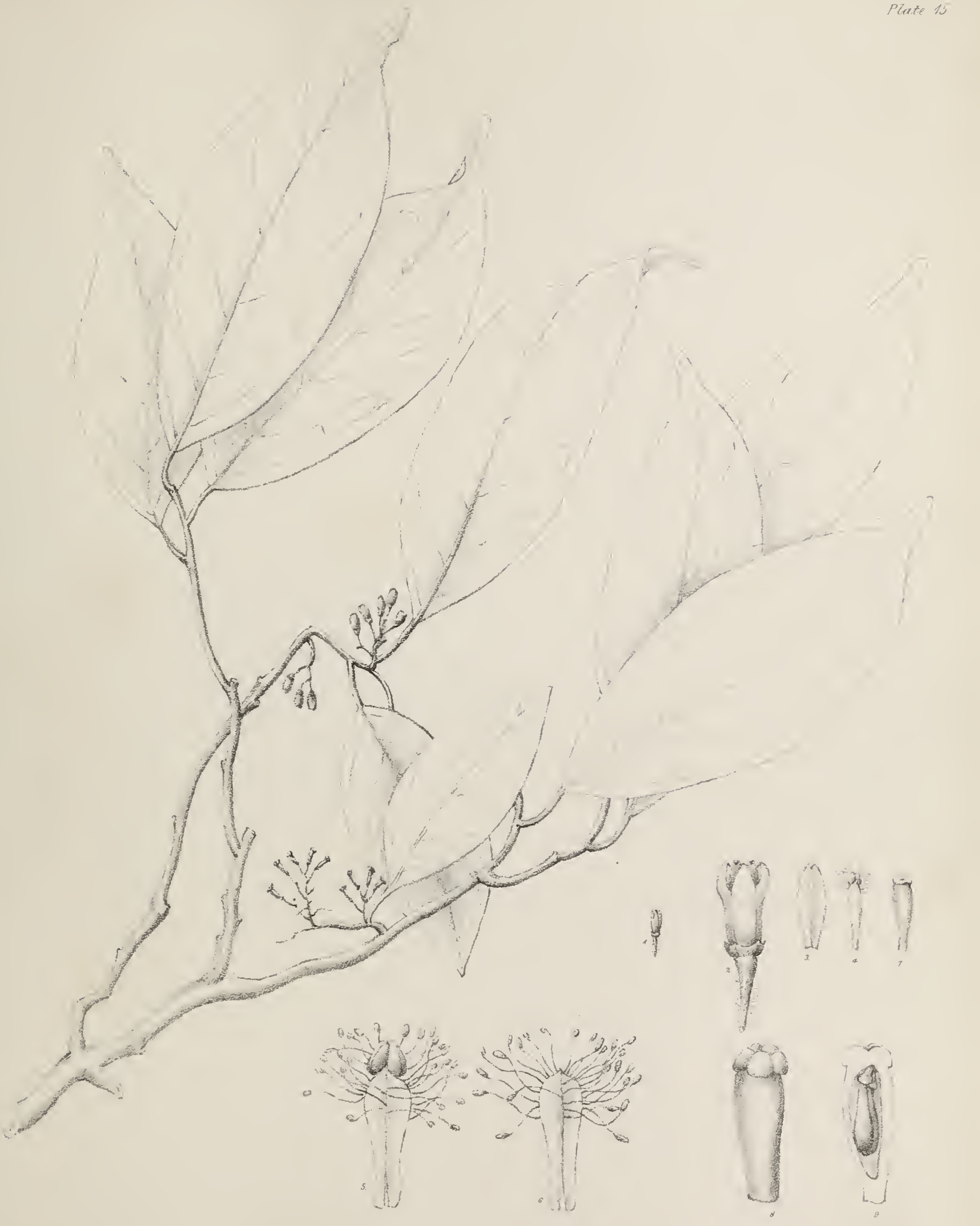
S CEYLANICUS

STEMONURUS

S. WALKERI

J Miers del

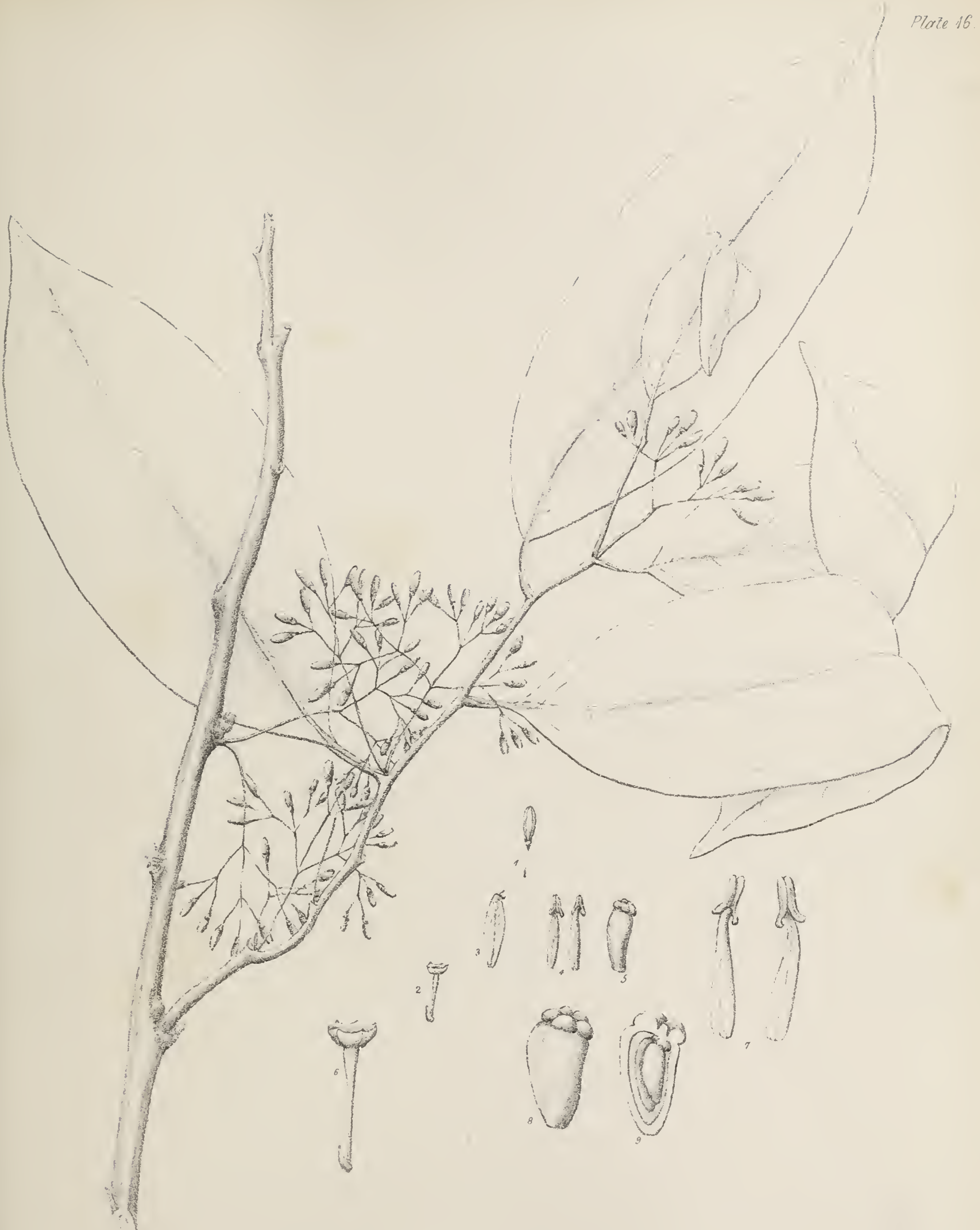
Hullmandel & Walton, lith



J Miers, del.

STEMONURUS AFFINIS

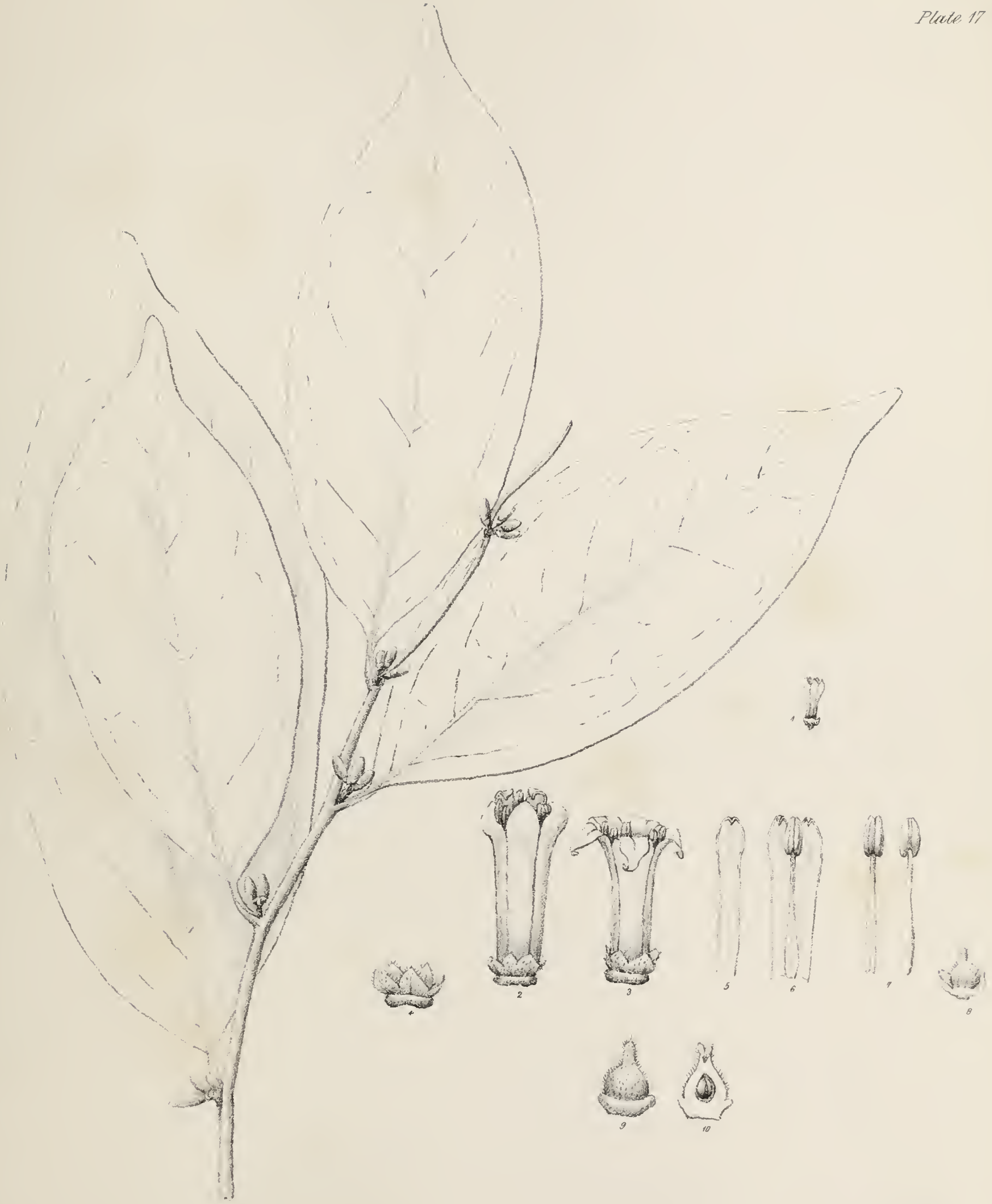
Hullmandel & Walton, lith



M[illegible] del.

Hullmandel & Walton lith.

PLATEA LAXIFLORA

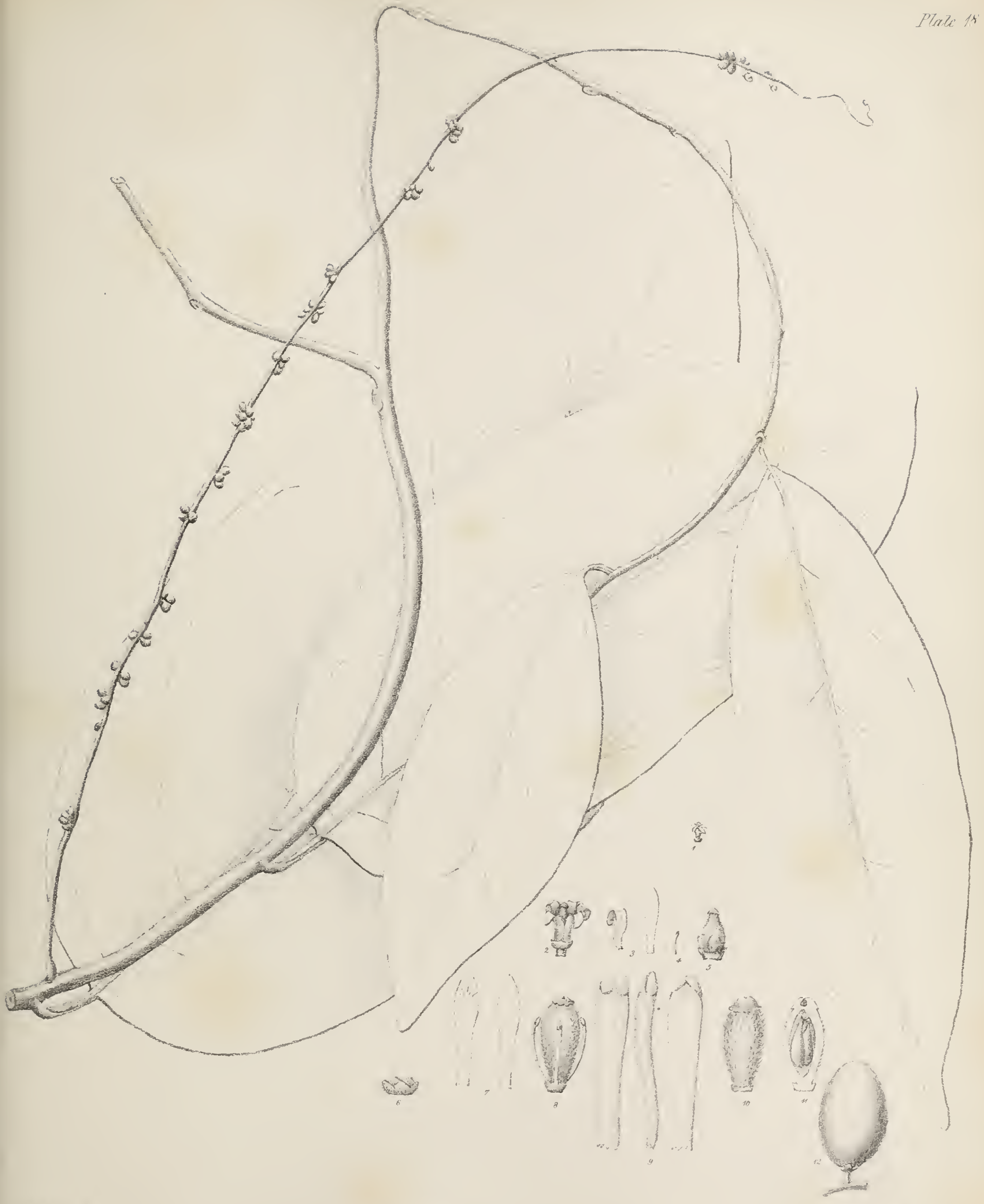


J. Miers, del.

Printed by Hullmandel & Walton.

PLATEA LOBBIANA

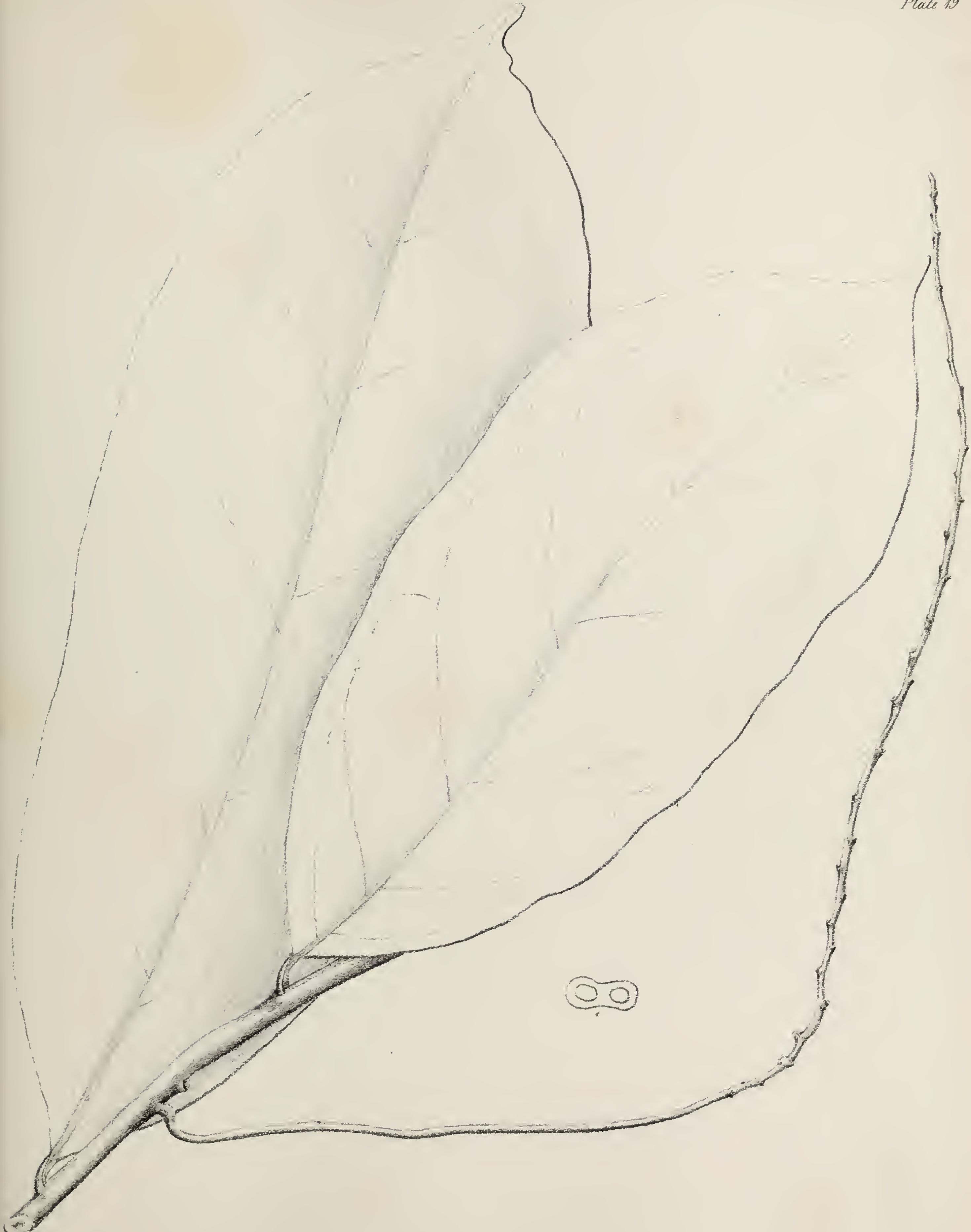
Plate 18



J. Miers del.

[illegible] anuel & Welton lith.

SARCOSTIGMA KLEINII

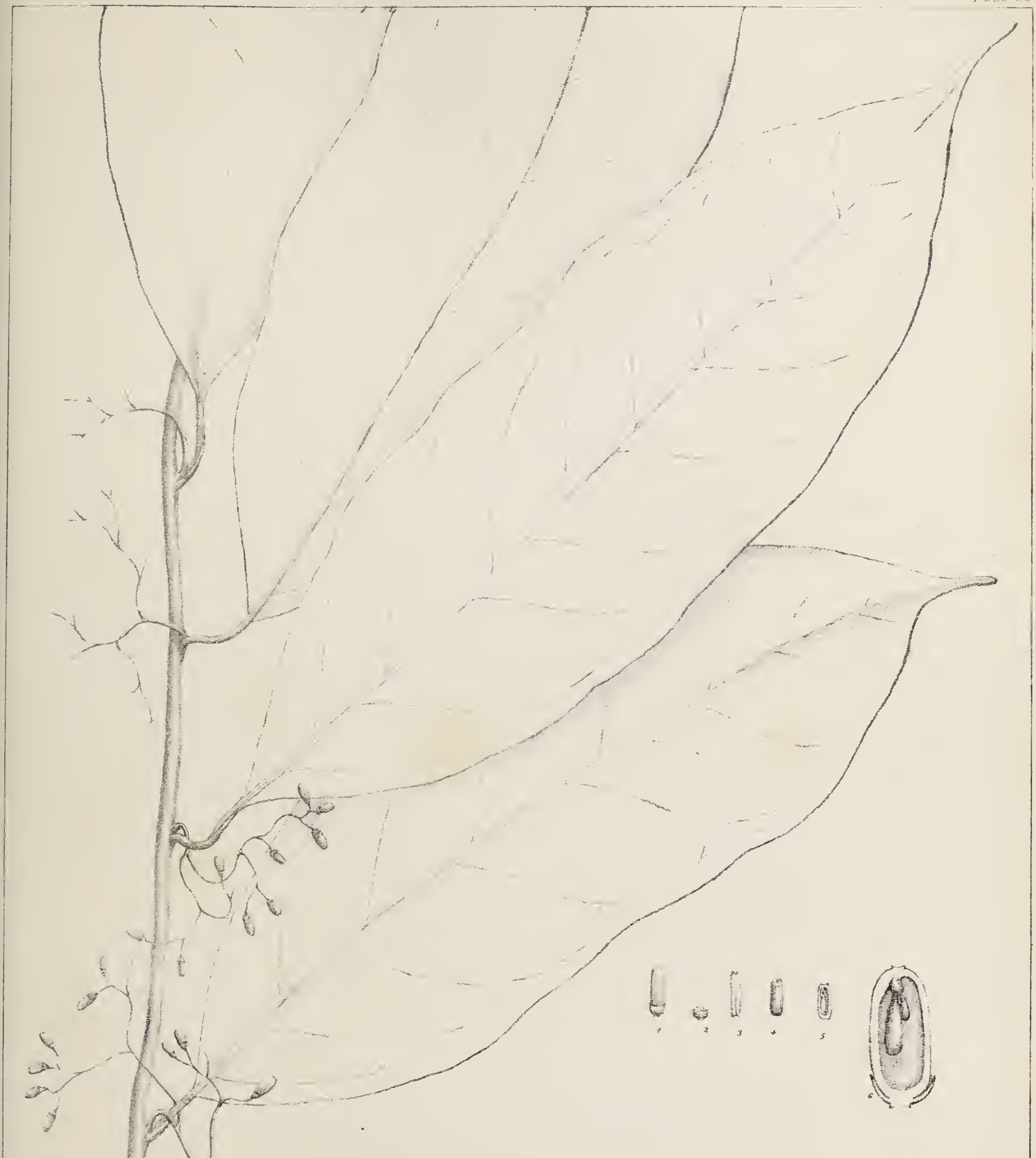


J. Miers, del.

Hullmandel & Walton lith

SARCOSTIGMA VOGELII

Plate .0

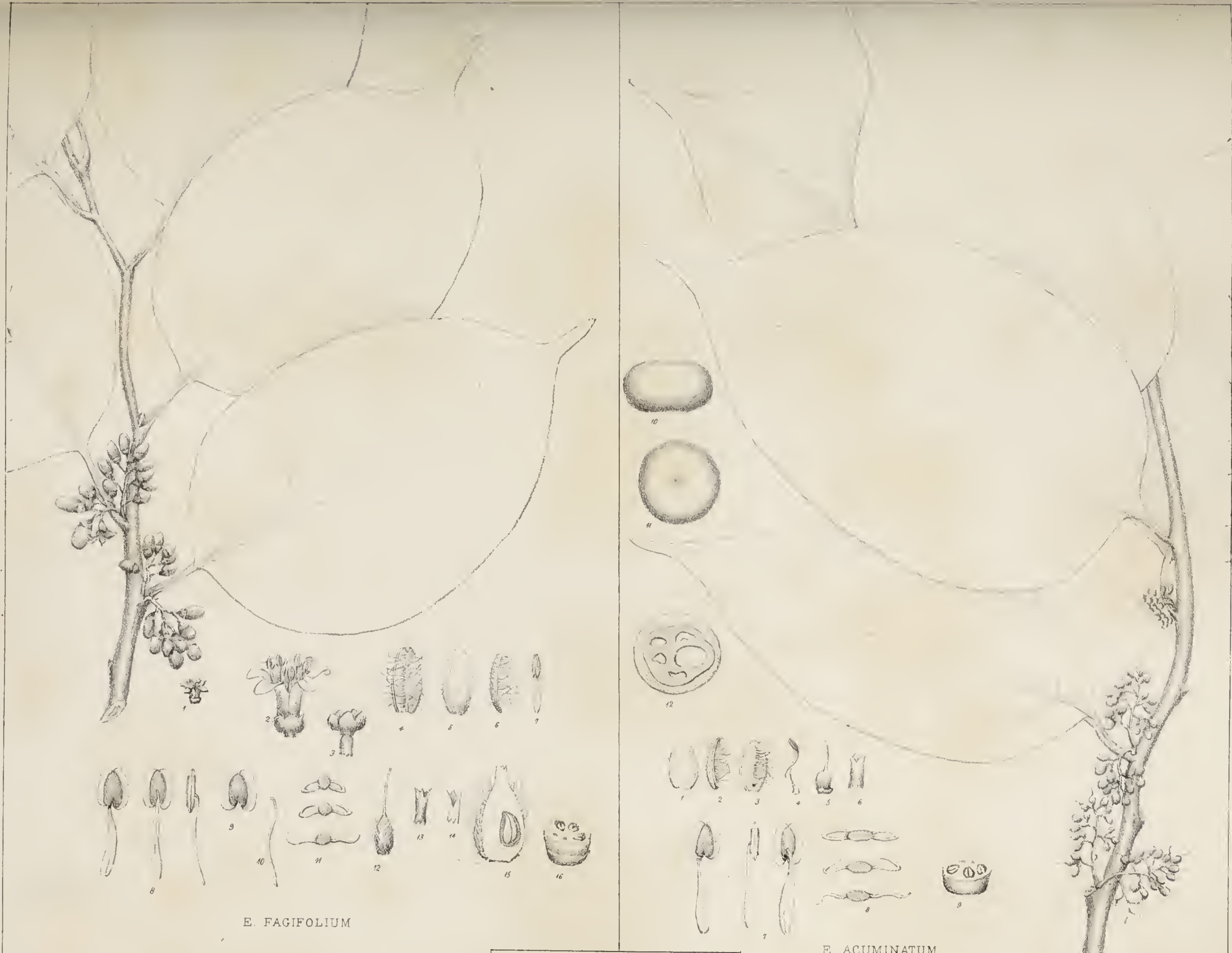


DISCOPHORA GUIANENSIS.

J. Miers, del

Hullmandel & Walton, lith

Plate 21



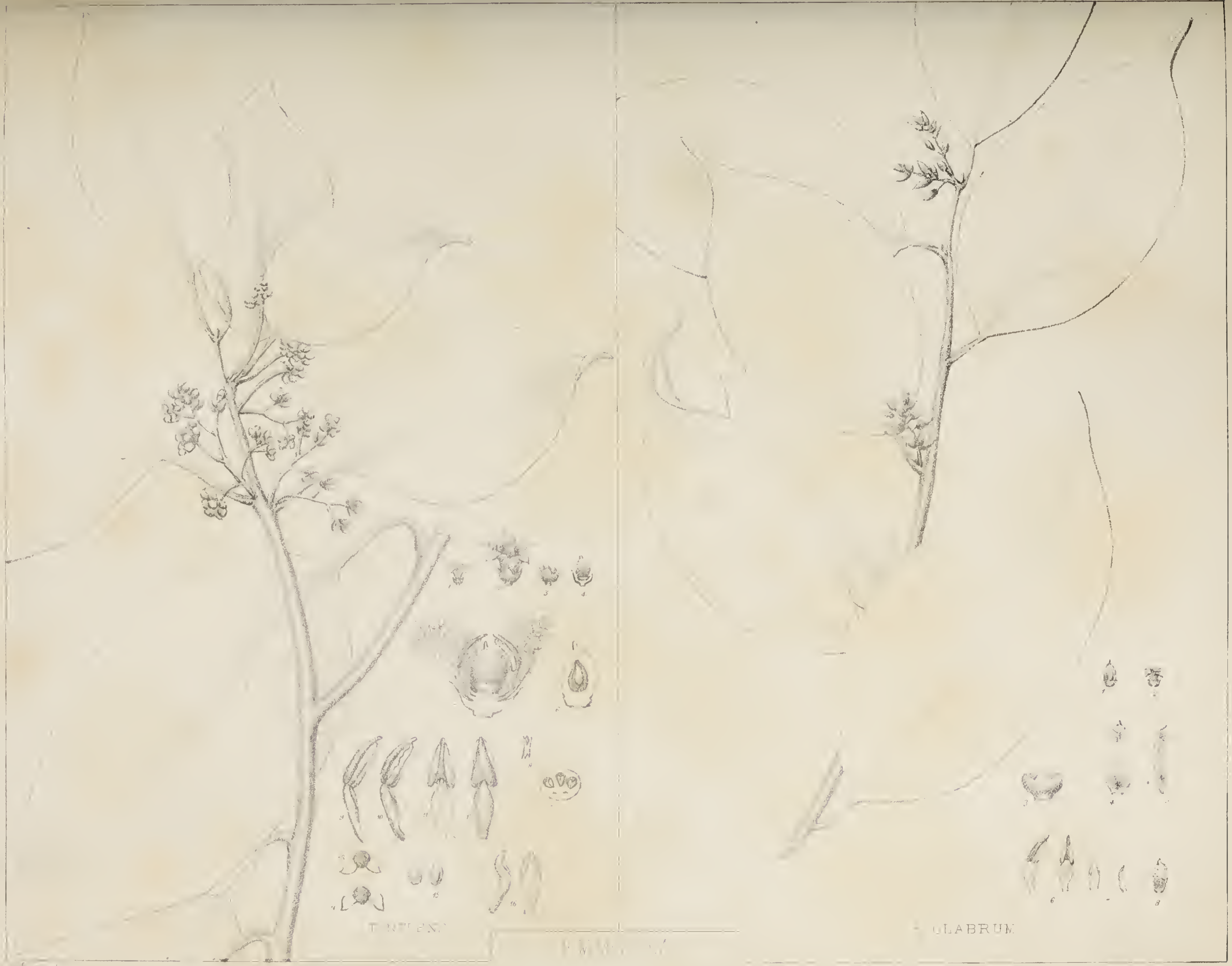
E. FAGIFOLIUM

E. ACUMINATUM

EMMOTUM.

J Miers. del.

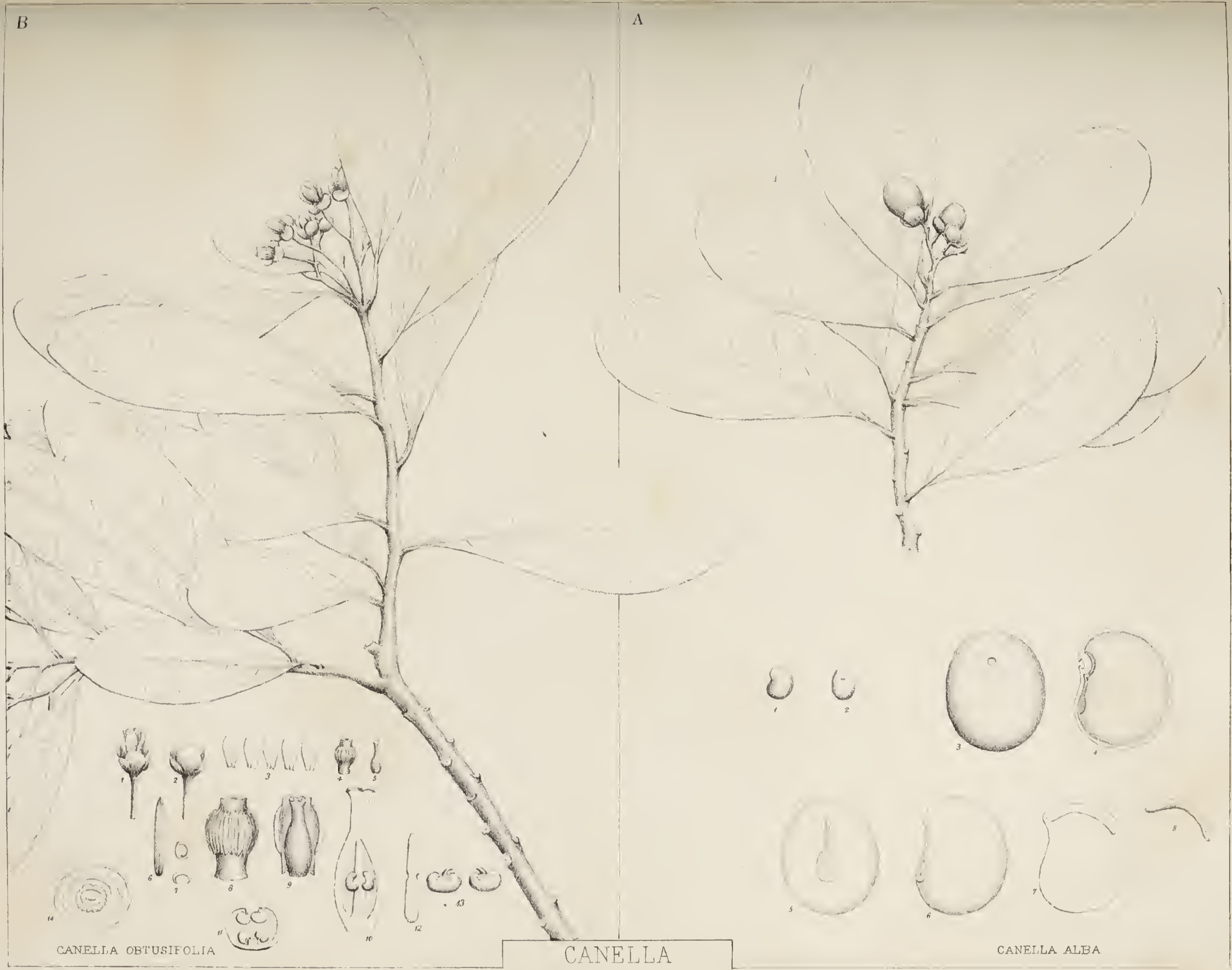
Hullmandel & Walton, lith.



[illegible] GLABRUM

ers, del.

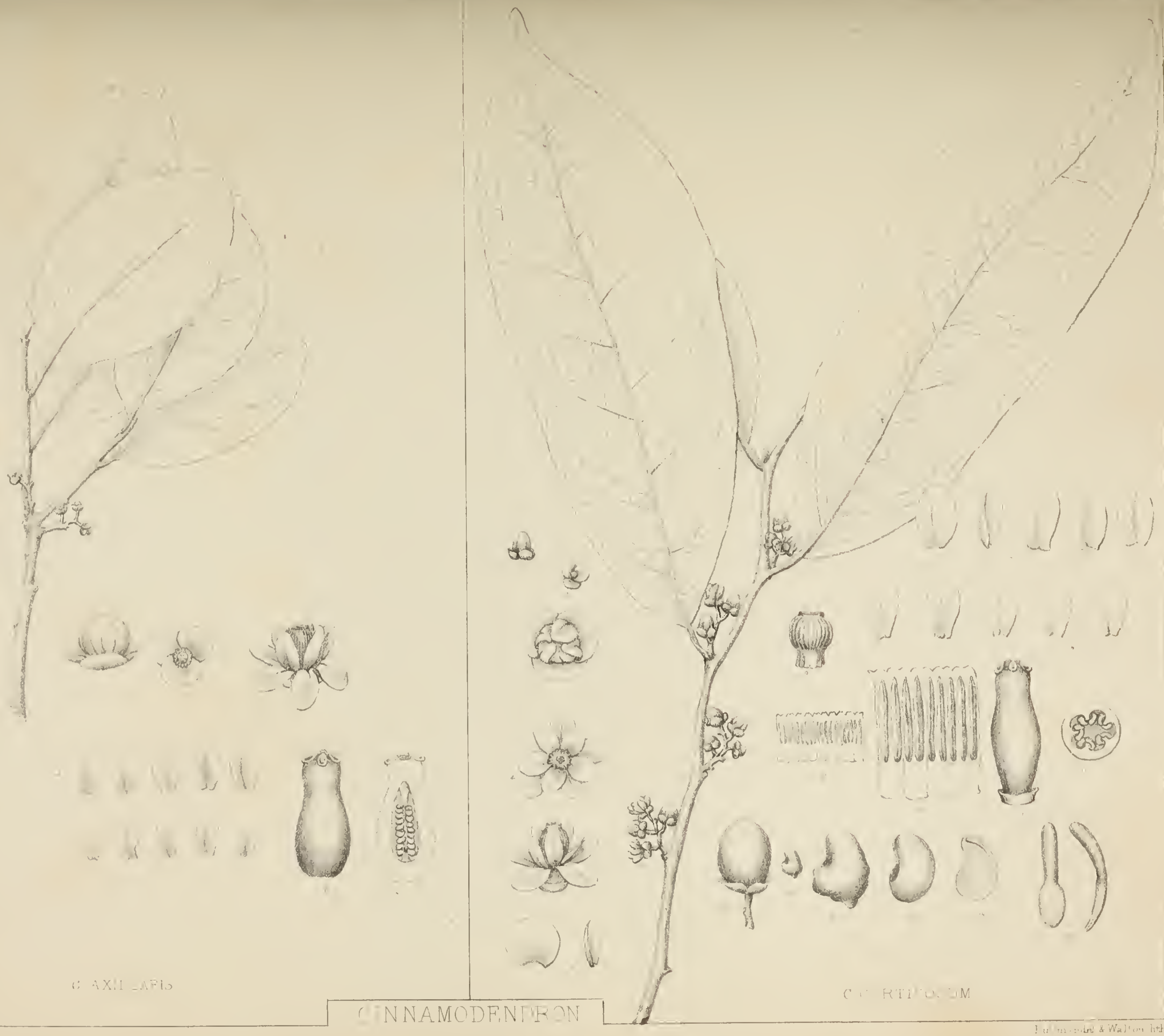
Hullmandel & Walton lith.



CANELLA OBTUSIFOLIA

CANELLA

CANELLA ALBA



C. AXILLARIS

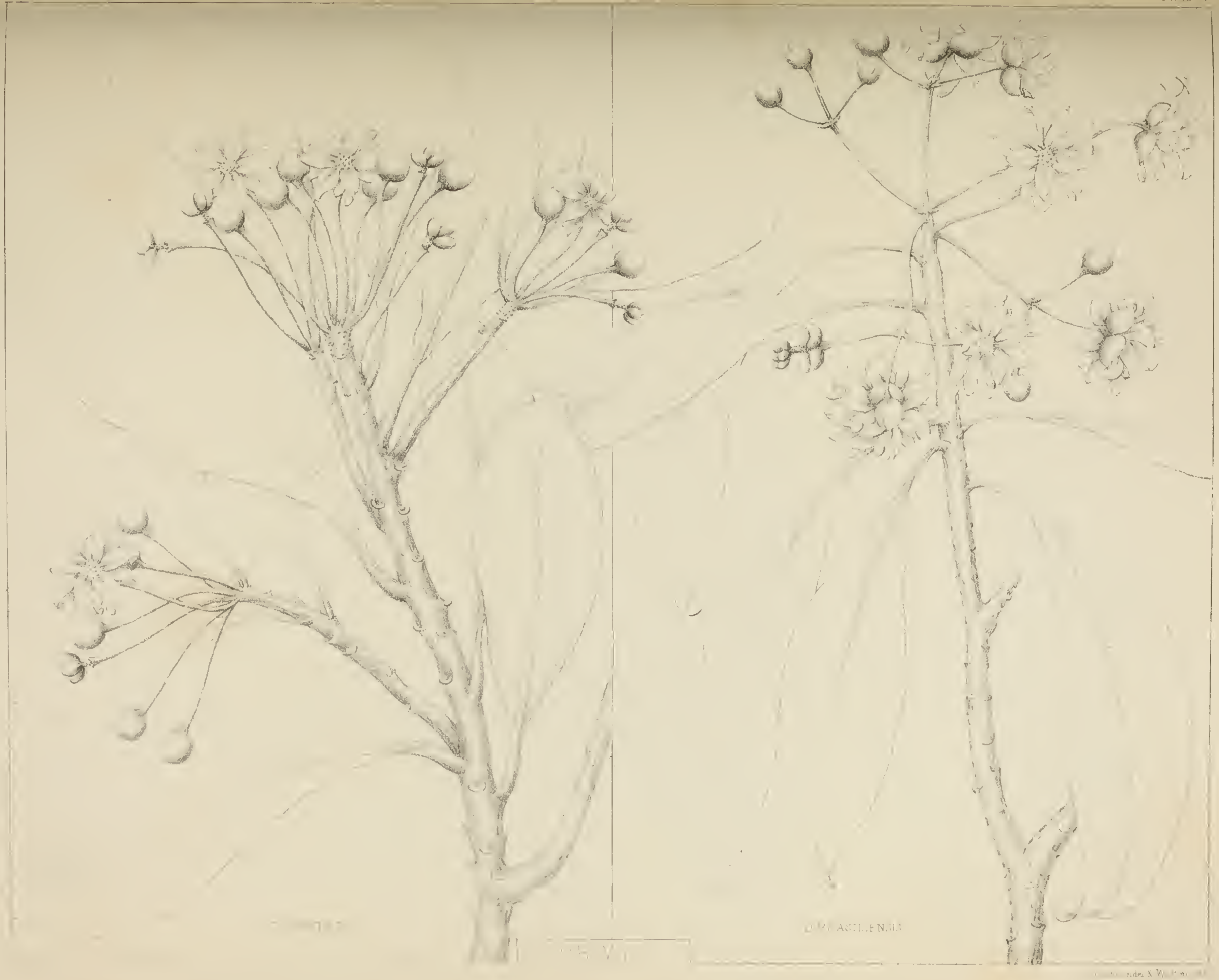
C. CORTICOSUM

CINNAMODENDRON

J. Miers del.

Hullmandel & Walton lith.

Plate 5



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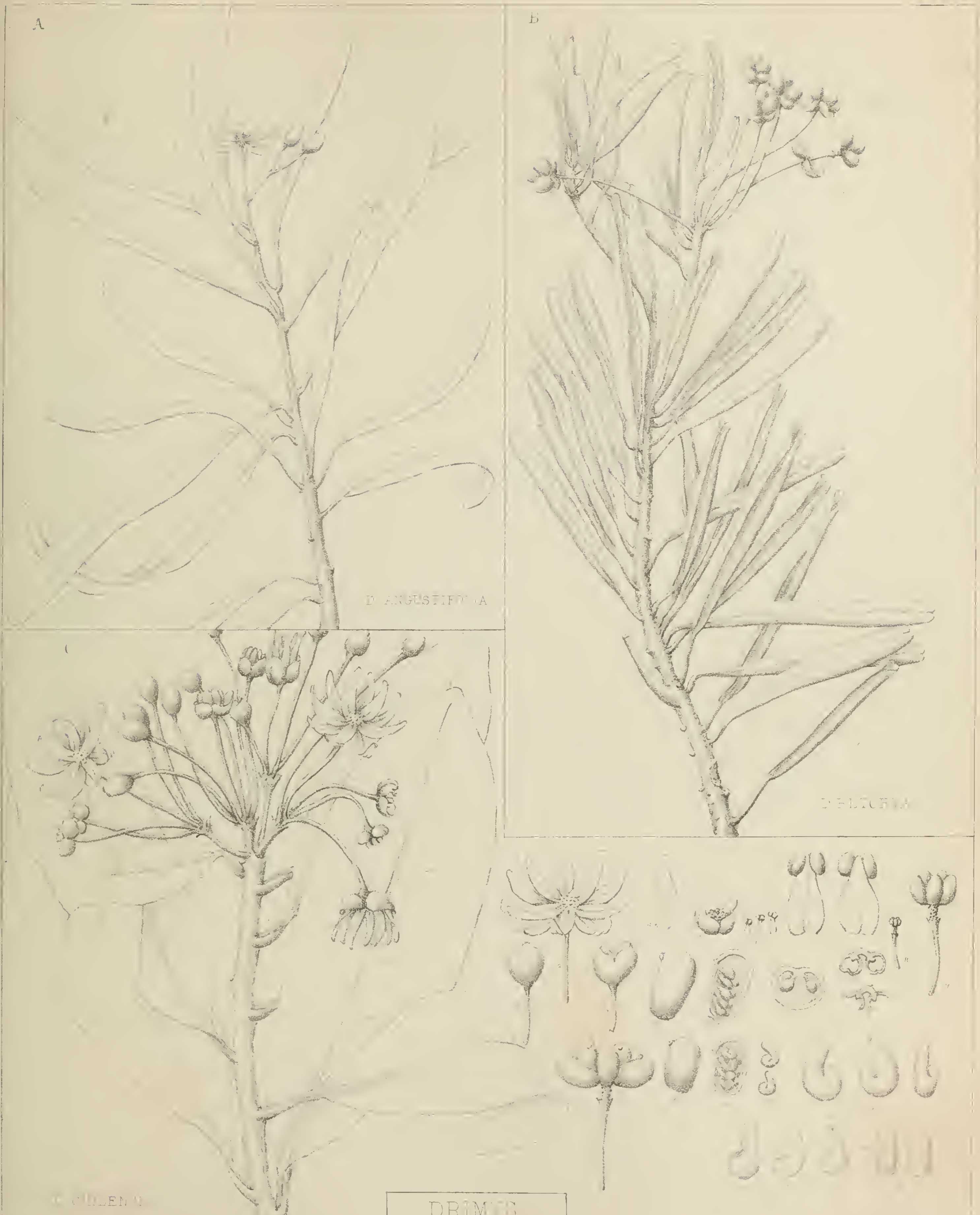
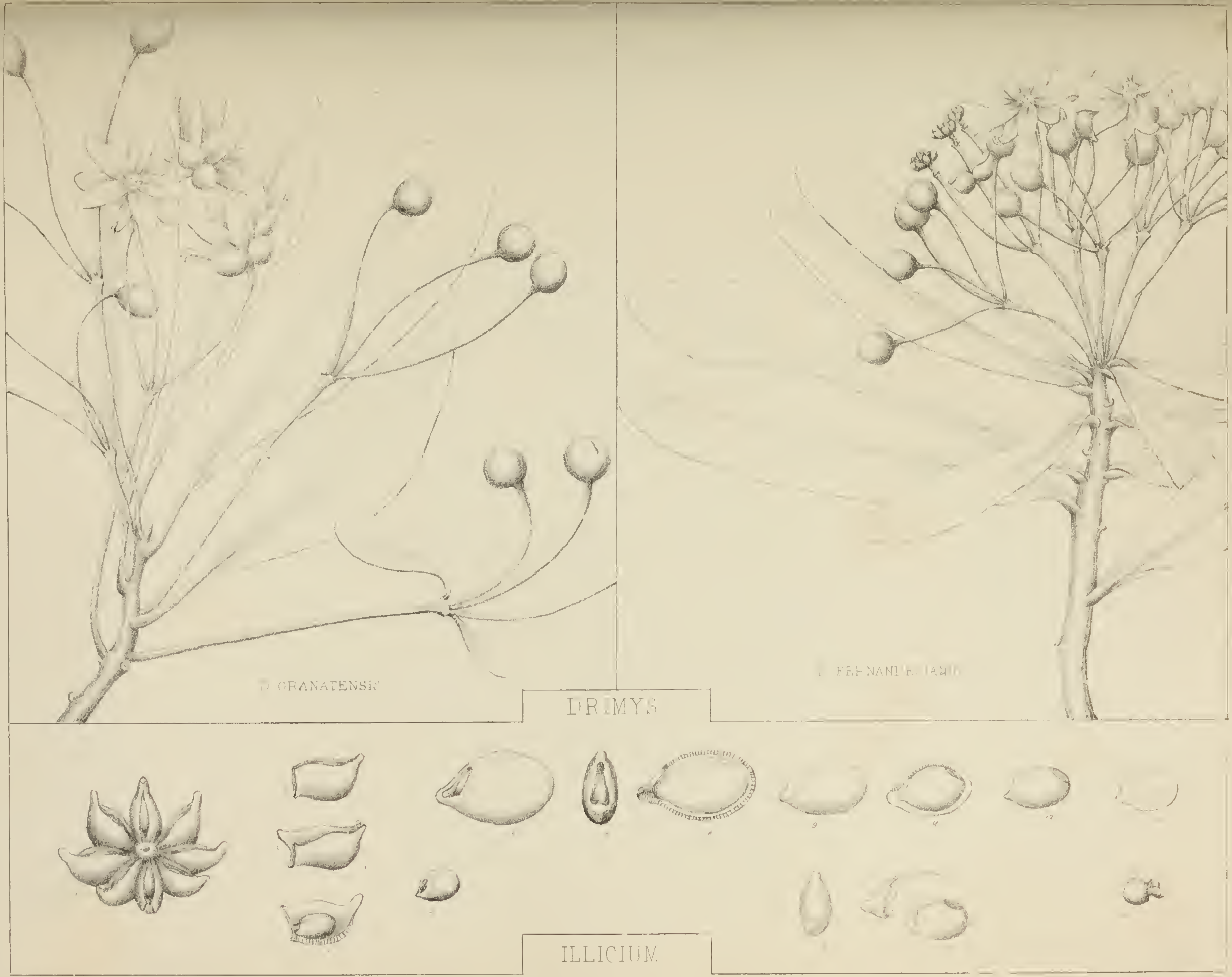


DRIMYS

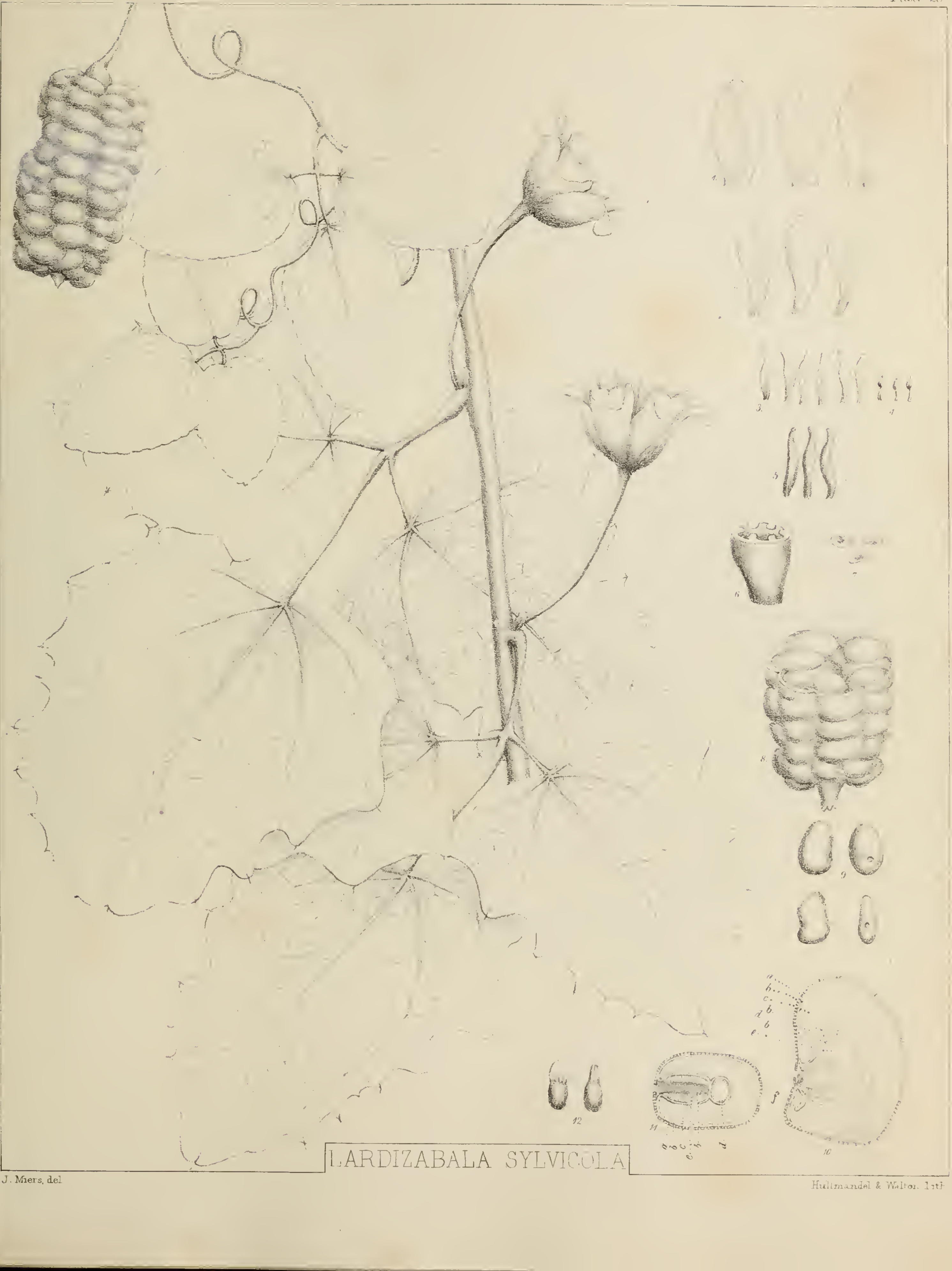
Miers del.



J. Miers del.

Hullmandel & Walton lith.

Plate 28

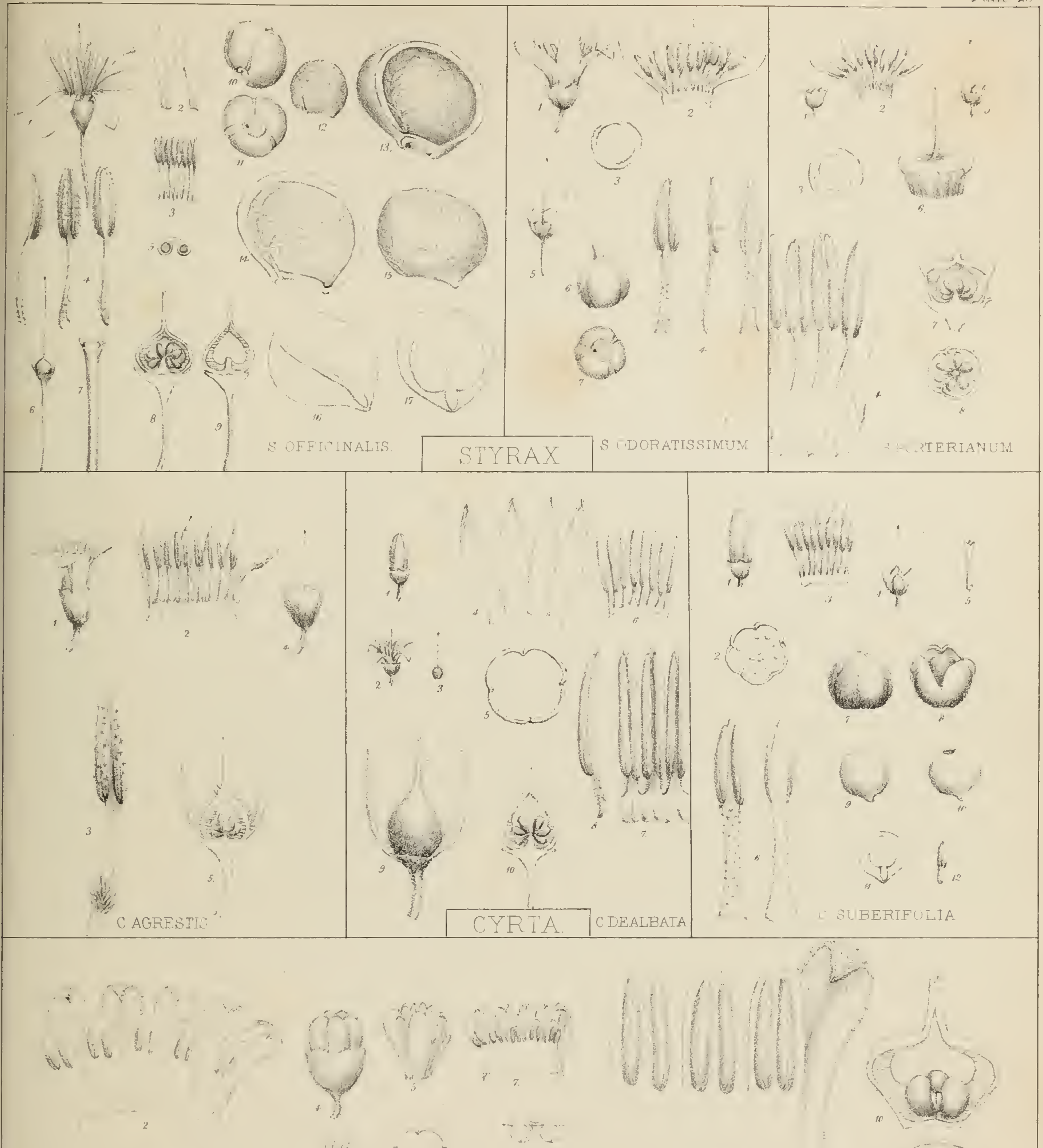


LARDIZABALA SYLVICOLA

J. Miers, del

Hullmandel & Walton, lith

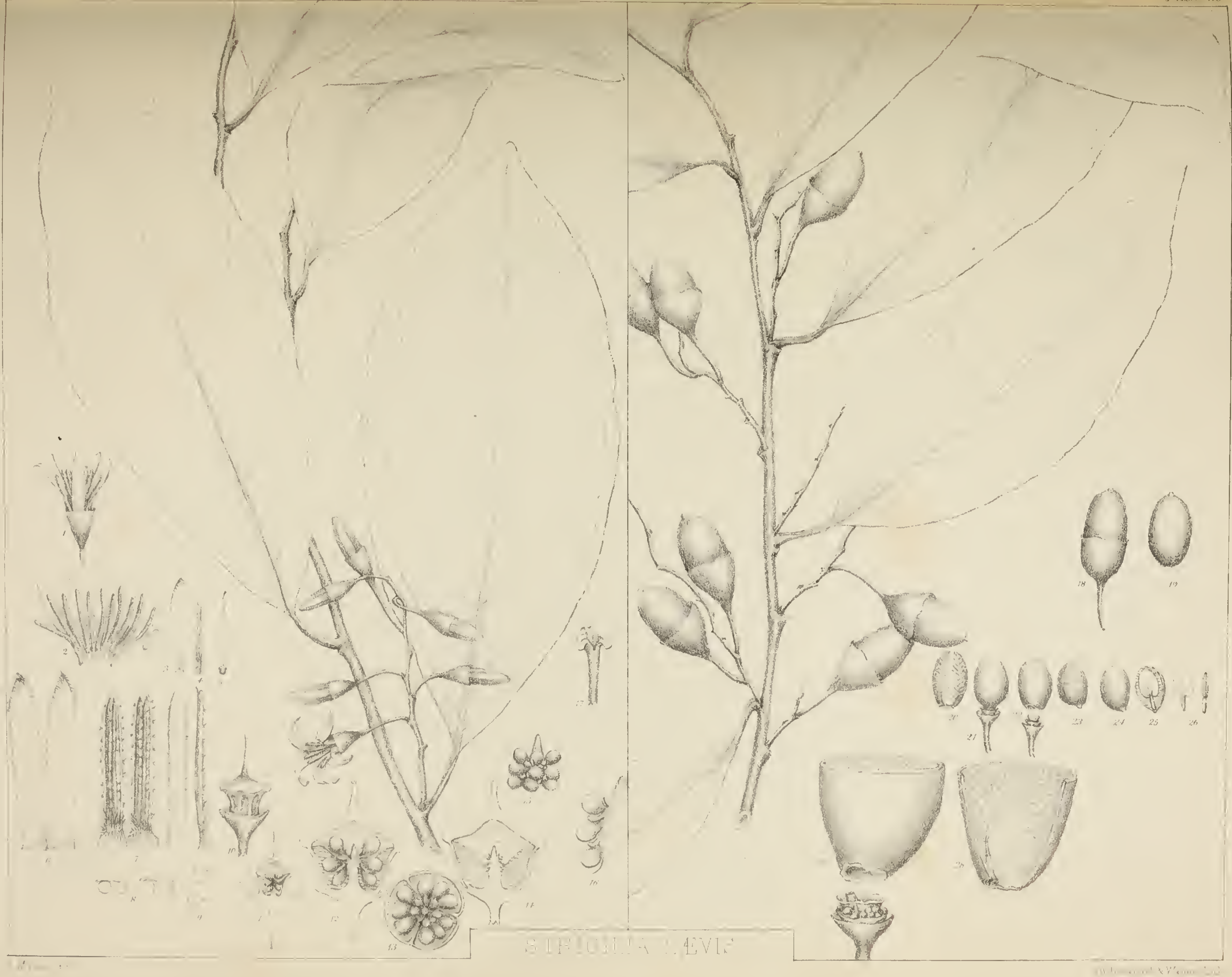
Plate 29



J Miers, del.

PAMPHILIA STYRACIFOLIA

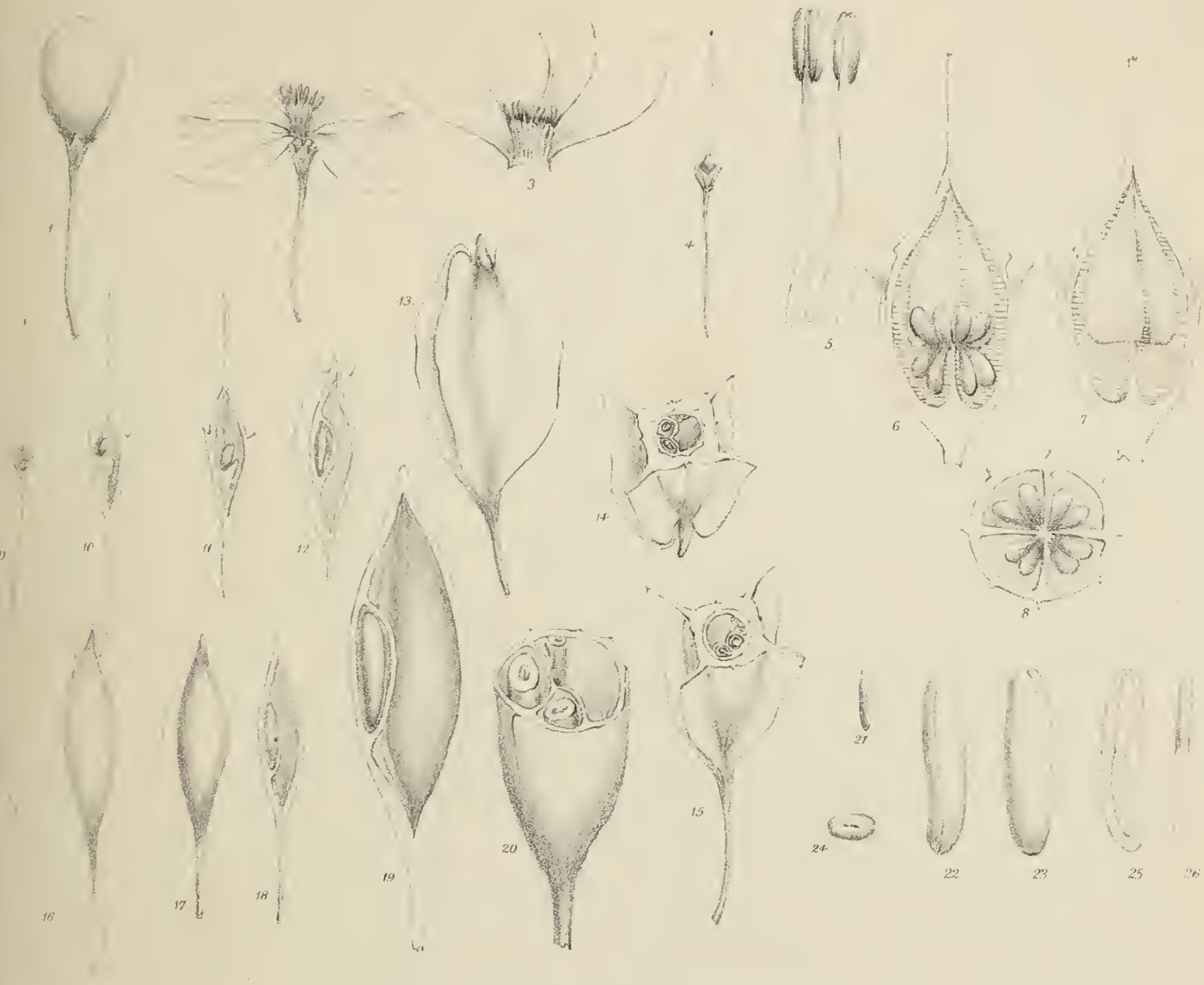
Hullmandel & Walton Lith.



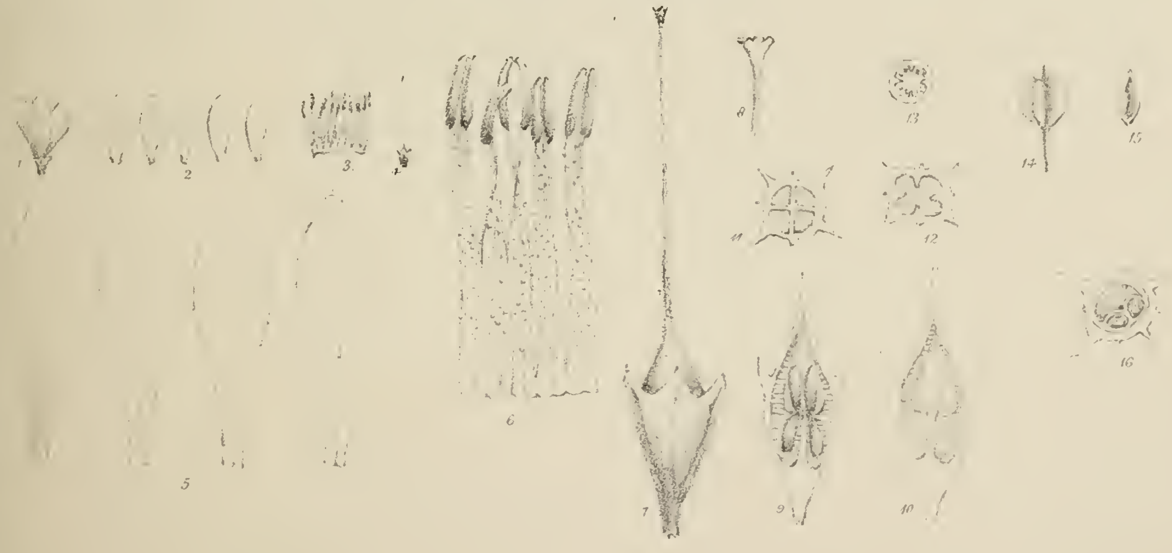
STRIGILIA LÆVIS

[illegible]

Plate 31



HALESIA TETRAPTERA

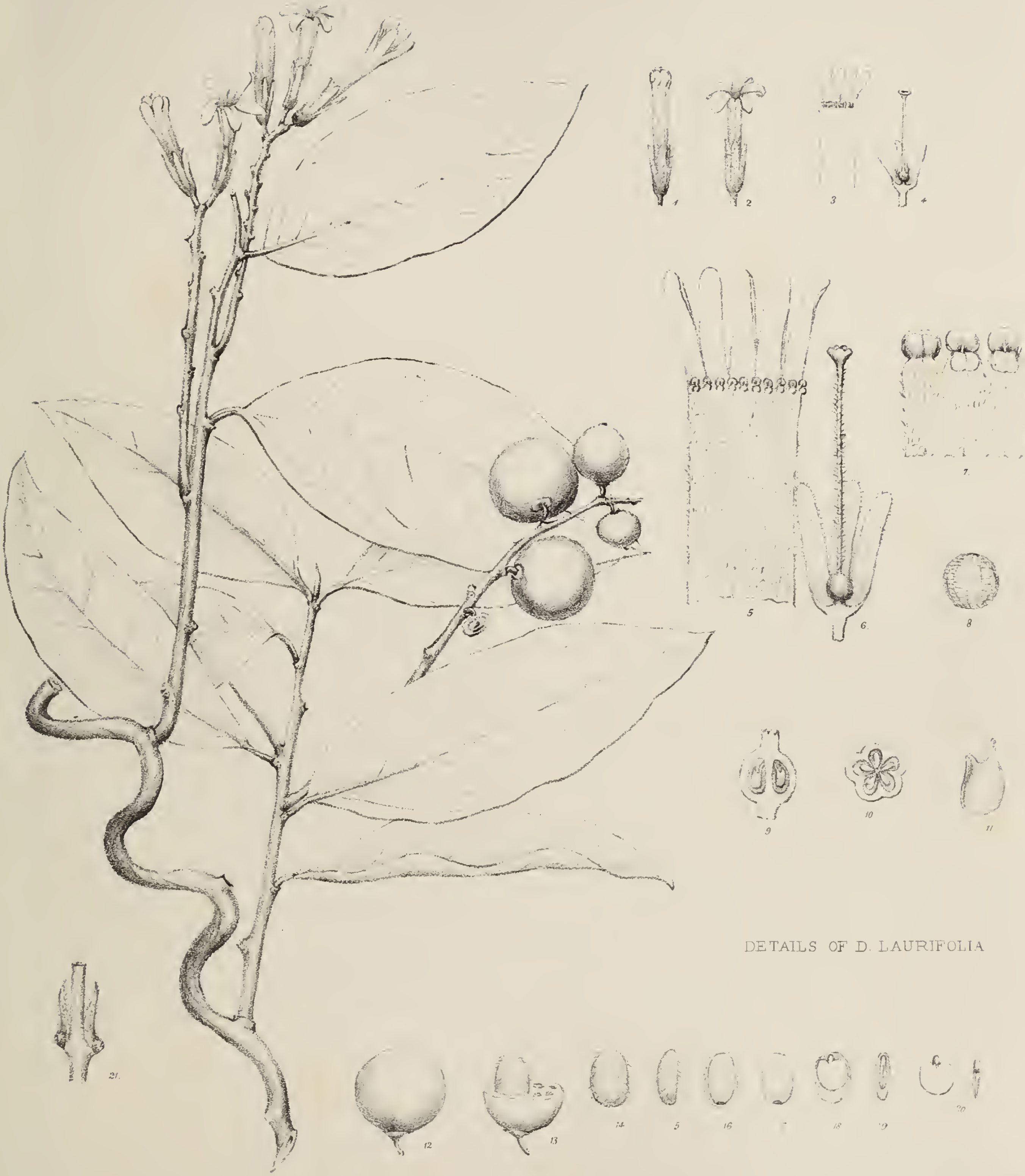


PTEROSTYRAX CORYMBOSA

J Miers del

Hullmandel & Walton Lith

Plate 32

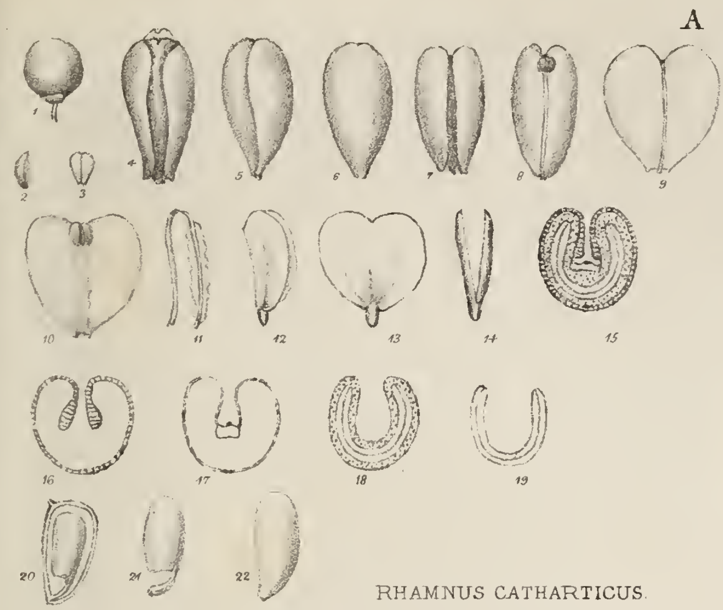


J. Miers, del.

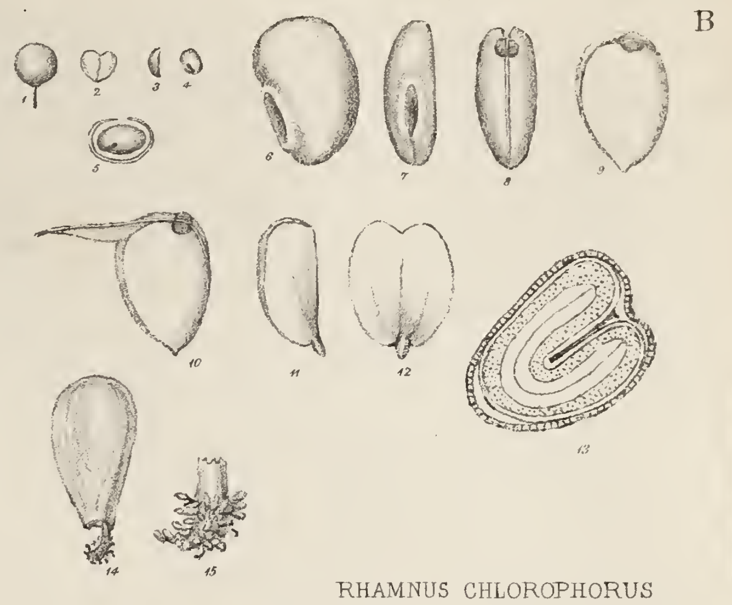
DICLIDANTHERA ELLIPTICA

Hullmandel & Walton lith.

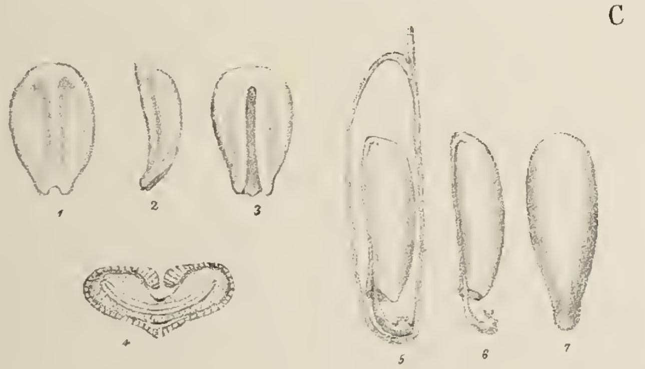
Plate 33



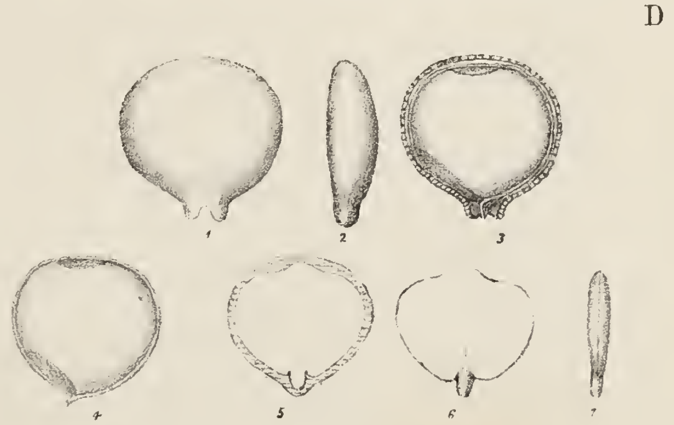
RHAMNUS CATHARTICUS.



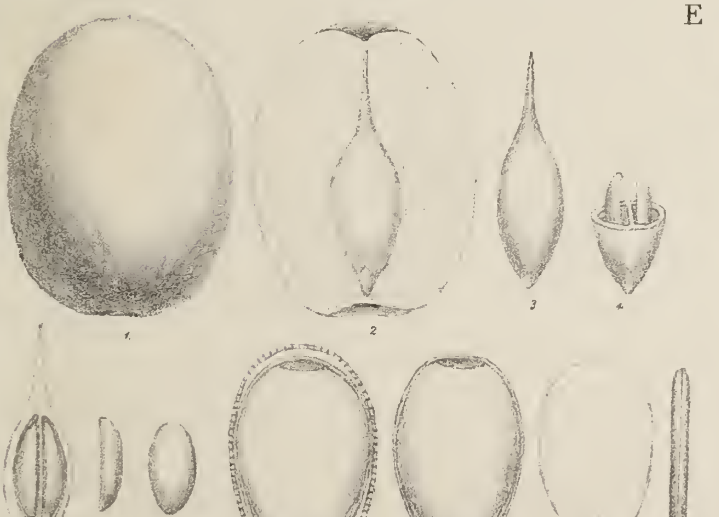
RHAMNUS CHLOROPHORUS



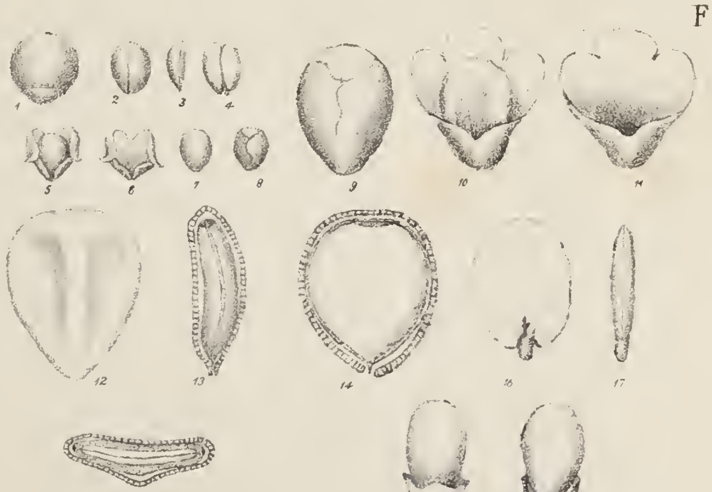
RHAMNUS ALATERNUS.



FRANGULA VULGARIS.



ZIZYPHUS SINENSIS.



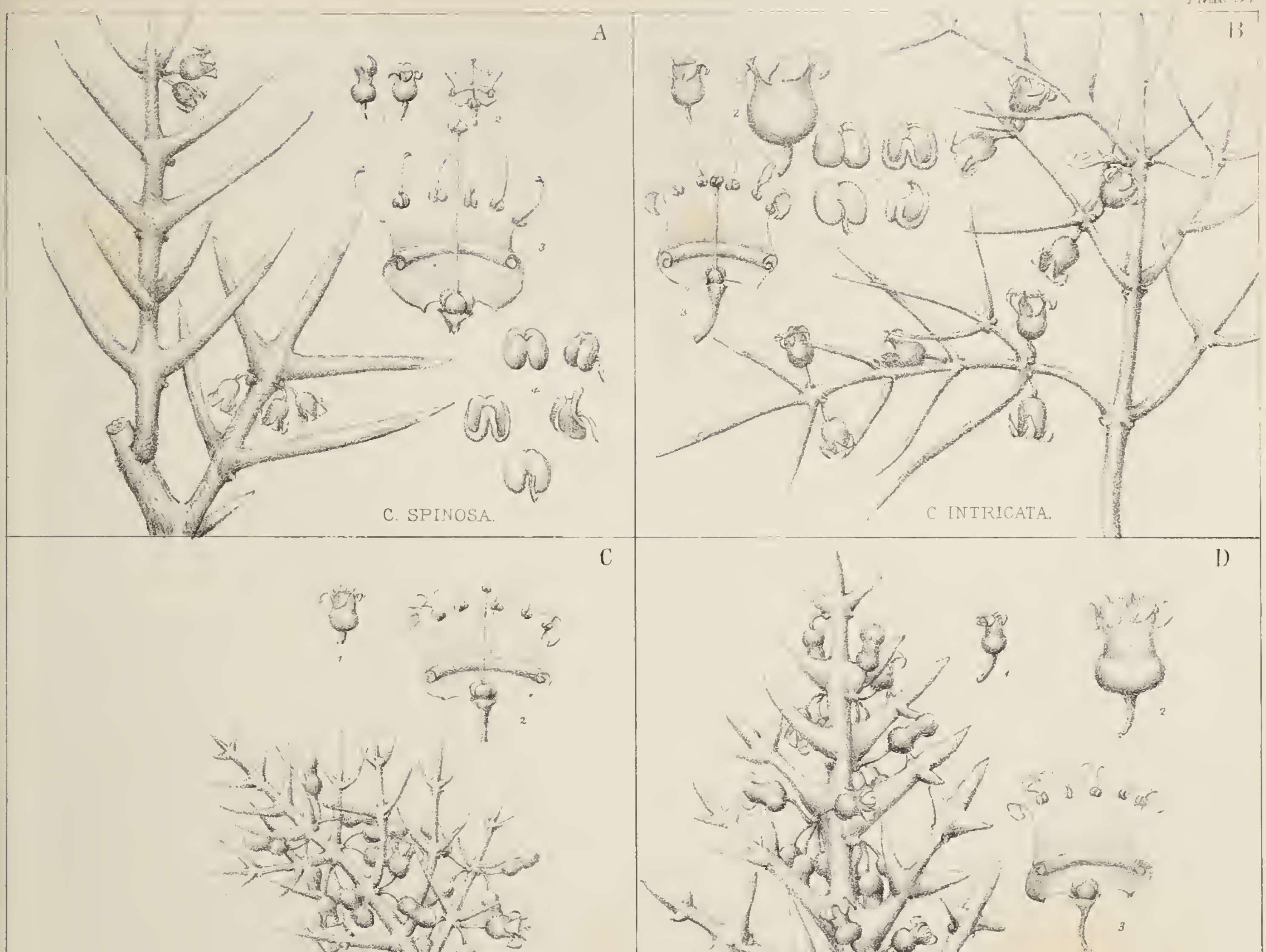
ALPHITOBIA EXCELSA

J. Miers, del.

RHAMNACEÆ.

Hullmandel & Walton lith.

Plate 34



C. SPINOSA.

C. INTRICATA.

C. FEROX

C. ATROX

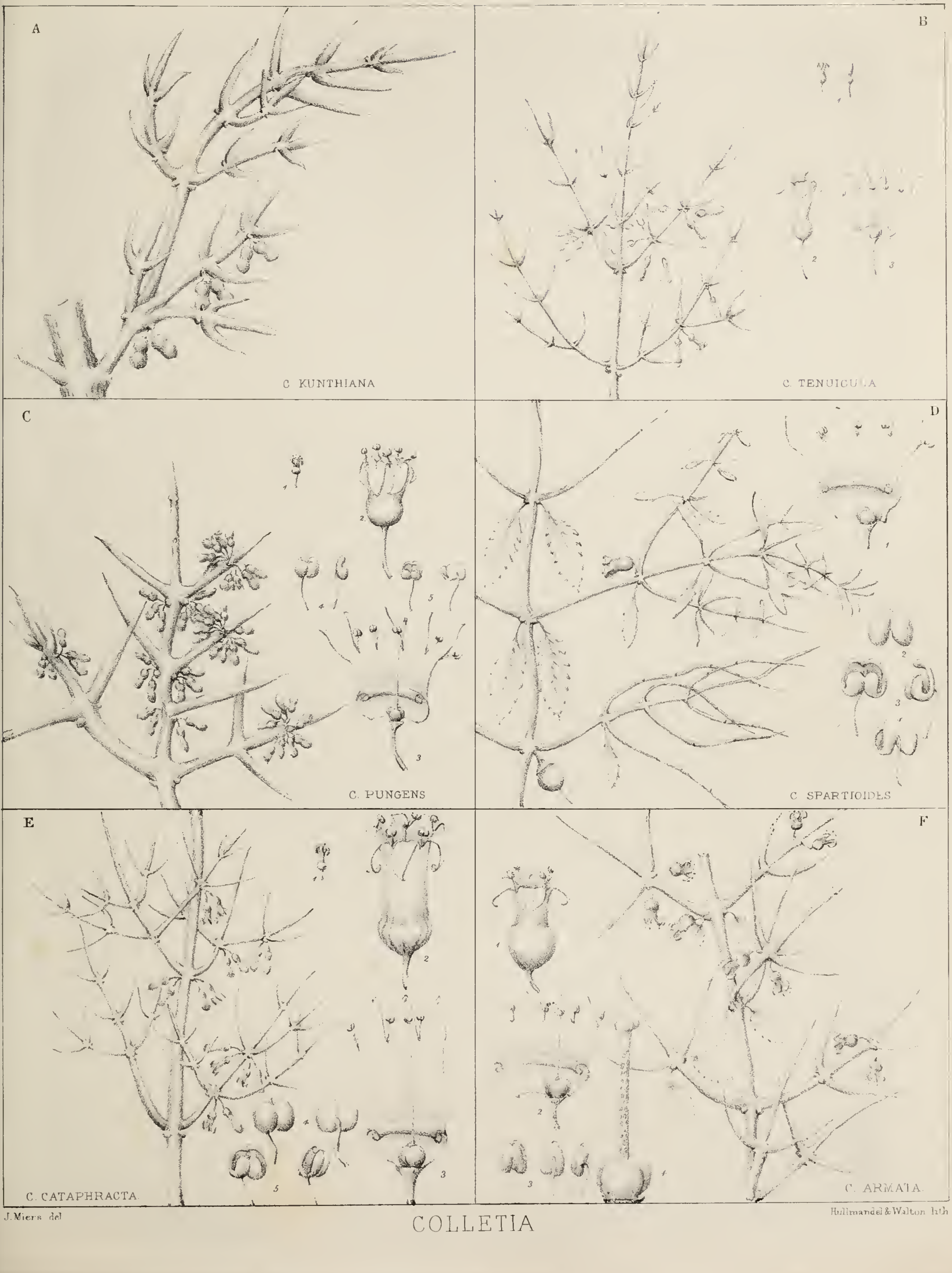
C. CRUCIATA

C. WEDDELLIANA.

J. Miers, del.

Hullmandel & Walton, lith

COLLETIA

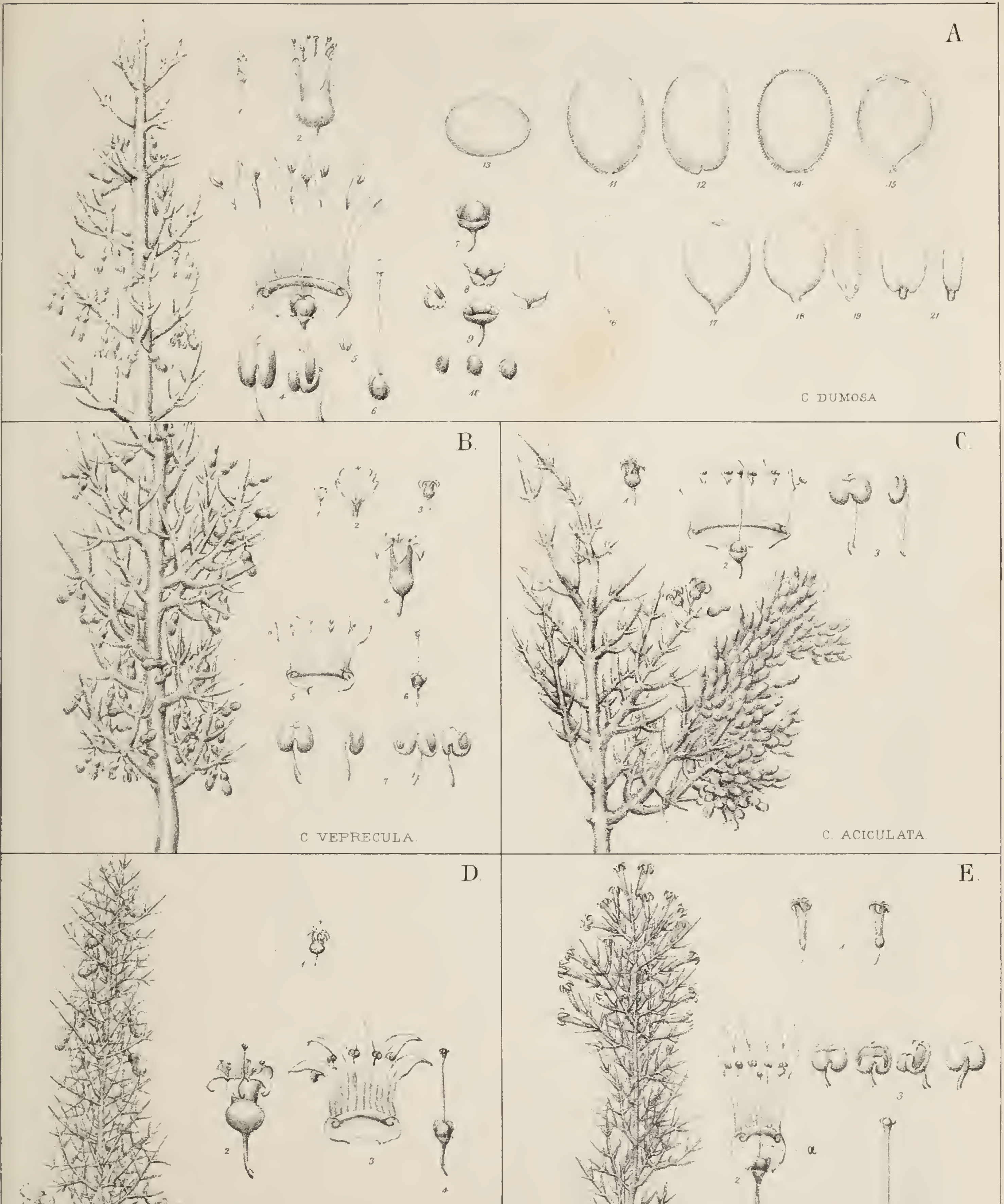


J. Miers del.

Hullmandel & Walton lith

COLLETIA

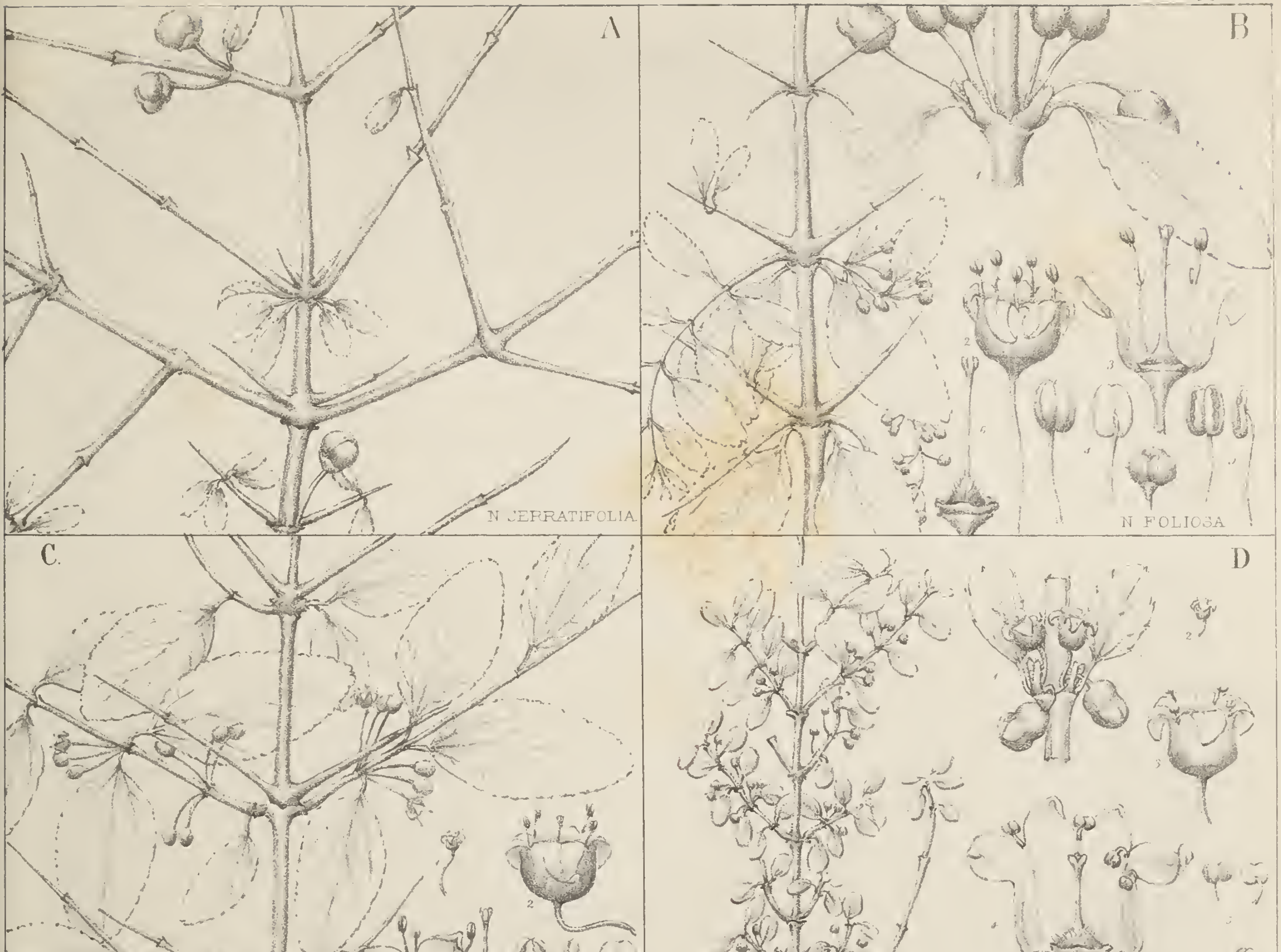
Plate 36



J. Miers, del

COLLETIA

Hullmandel & Walton lith

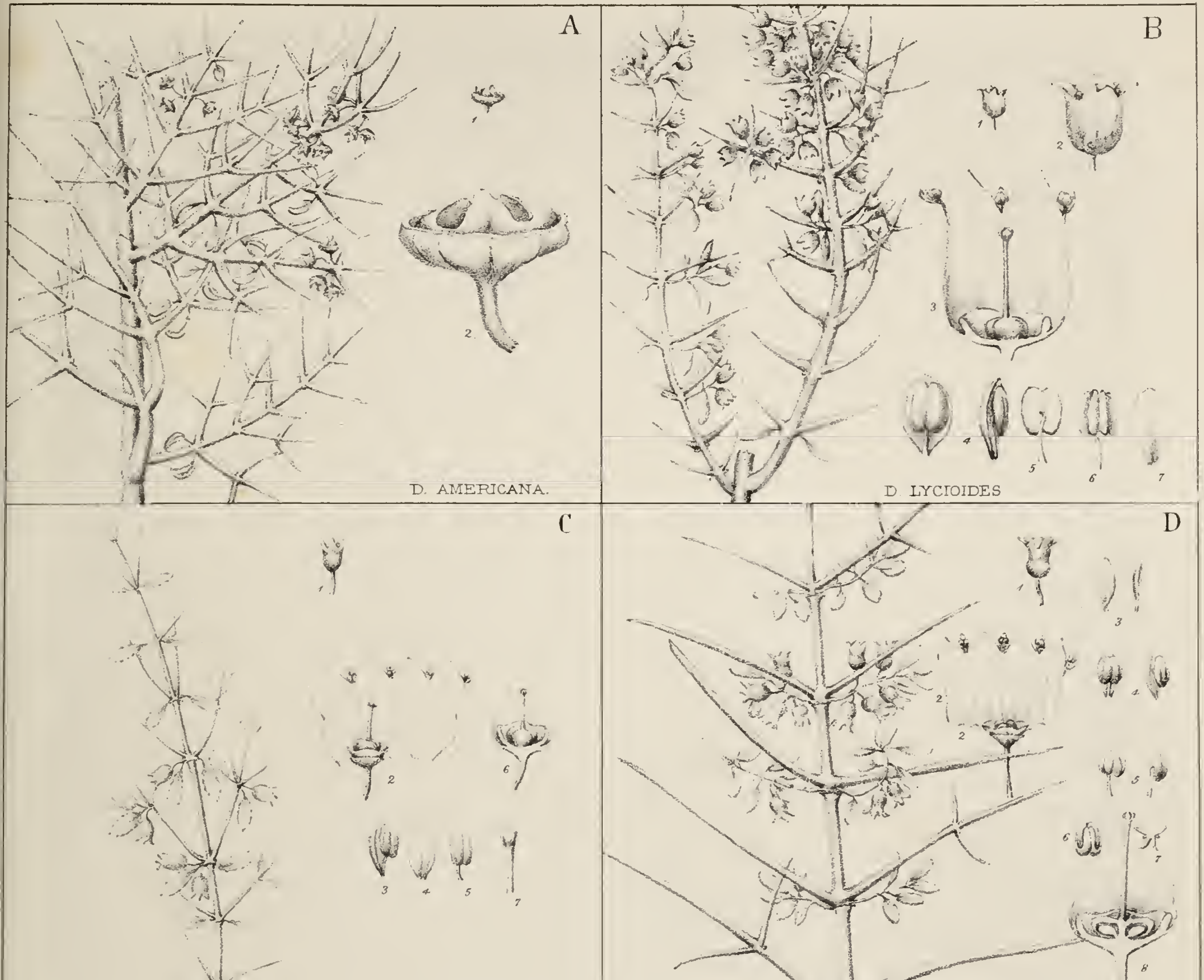


J. Miers, del.

Hullmandel & Walton lith.

NOTOPHÆNA.

Plate 38



D. AMERICANA.

D. LYCIOIDES

VAR. EXILIS

D. LONGISPINA.

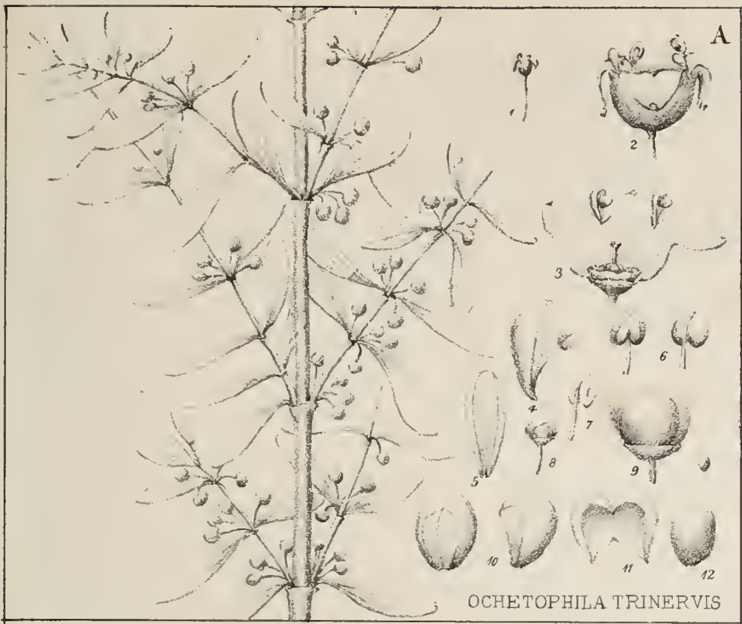
D. SPICULATA.

VAR. GRACILENTA

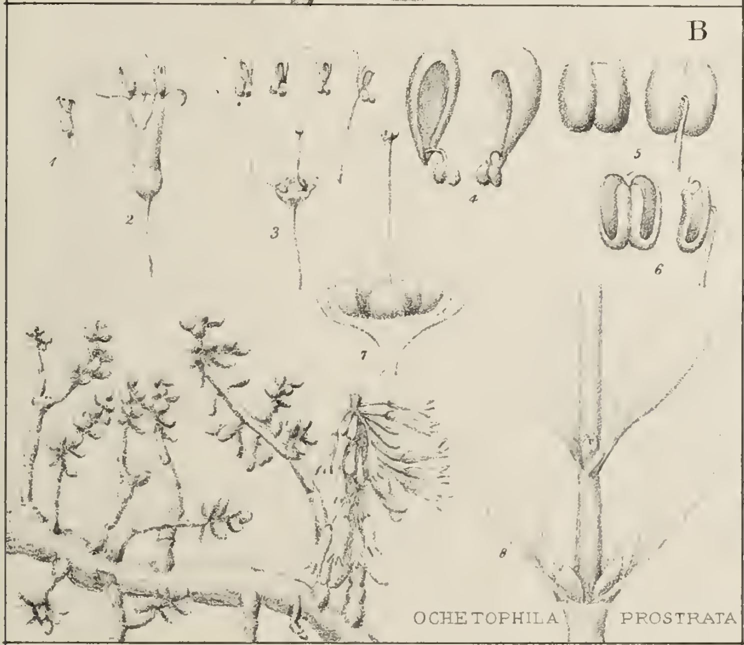
J Miers, del.

DISCARIA.

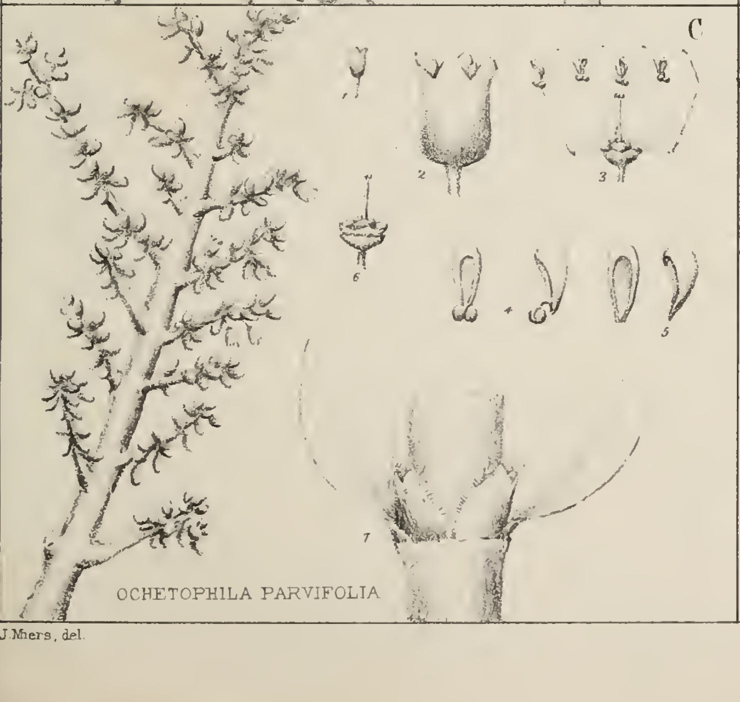
Hullmandel & Walton lith.



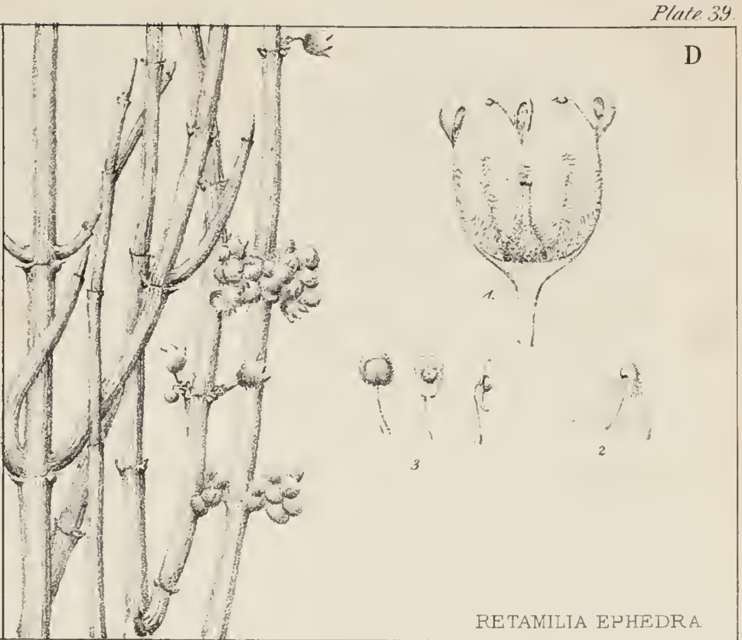
OCHETOPHILA TRINERVIS



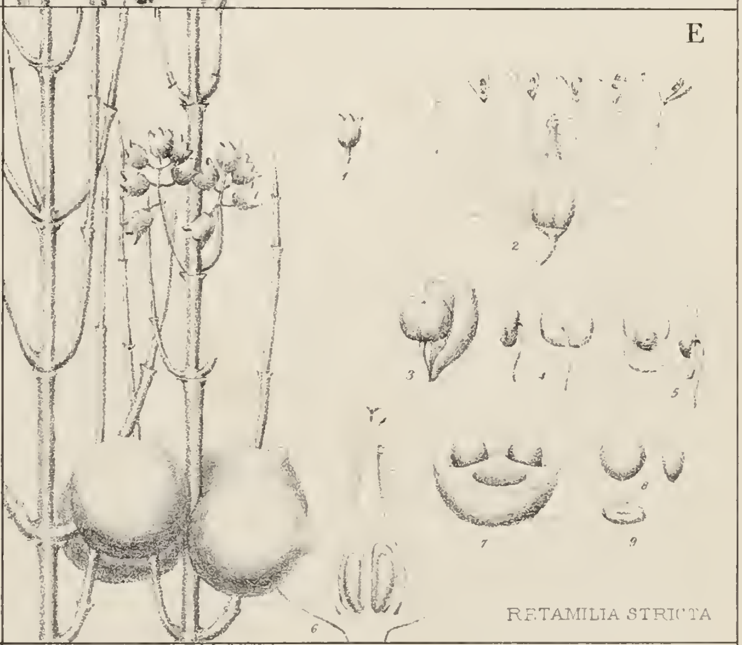
OCHETOPHILA PROSTRATA



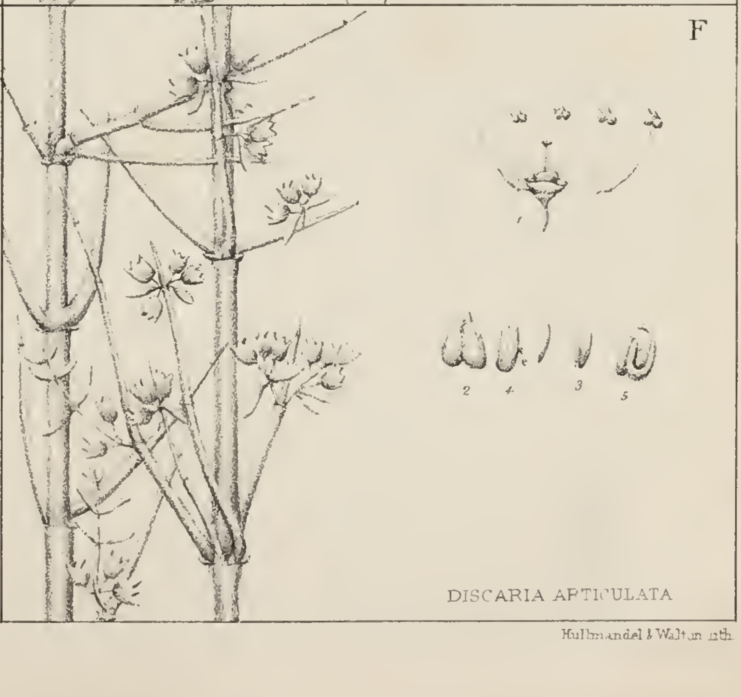
OCHETOPHILA PARVIFOLIA



RETAMILIA EPHEDRA



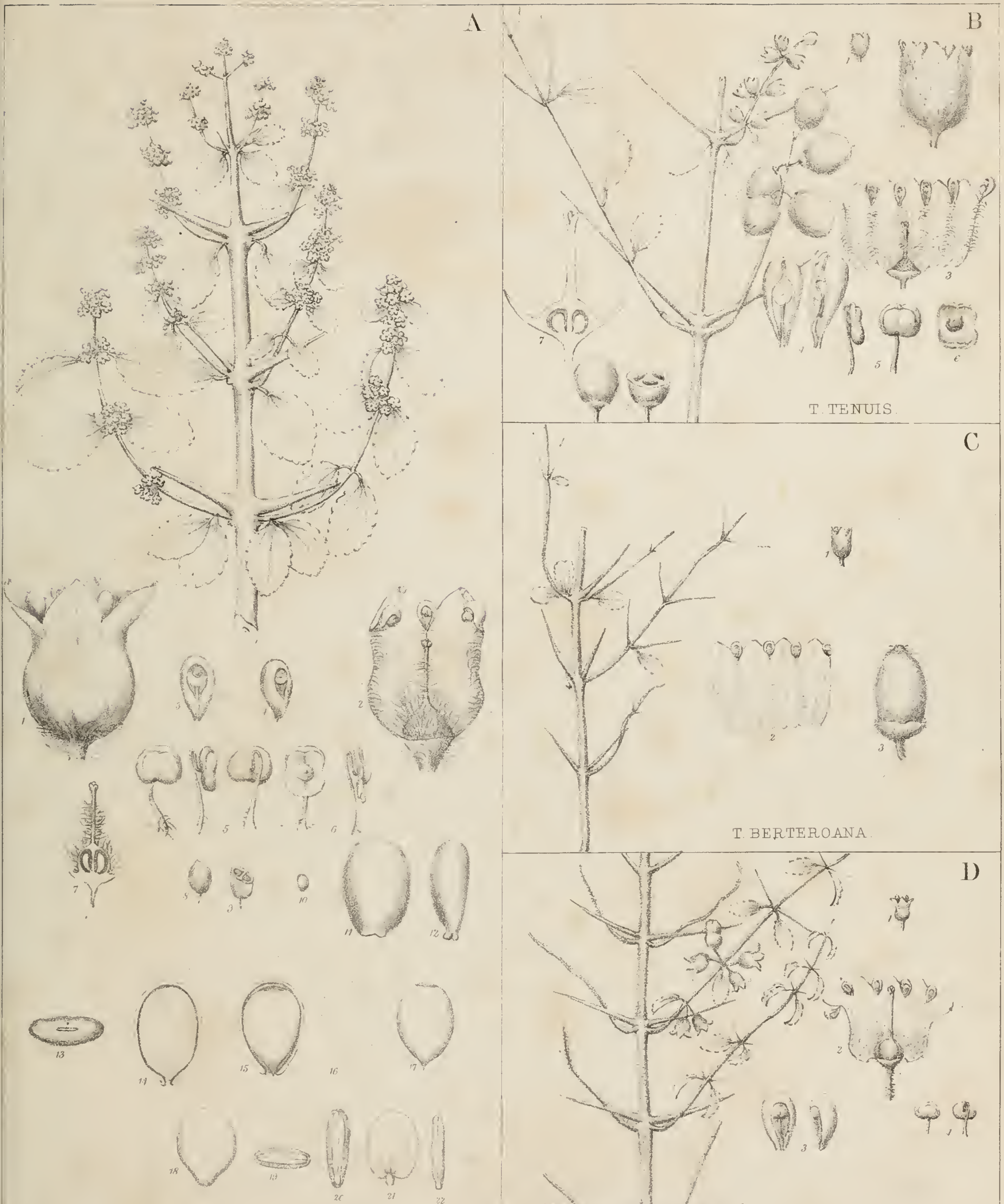
RETAMILIA STRICTA



DISCARIA ARTICULATA

J. Miers, del.

Hullmandel & Walton lith.



T. TRINERVIS

T. TENUIS.

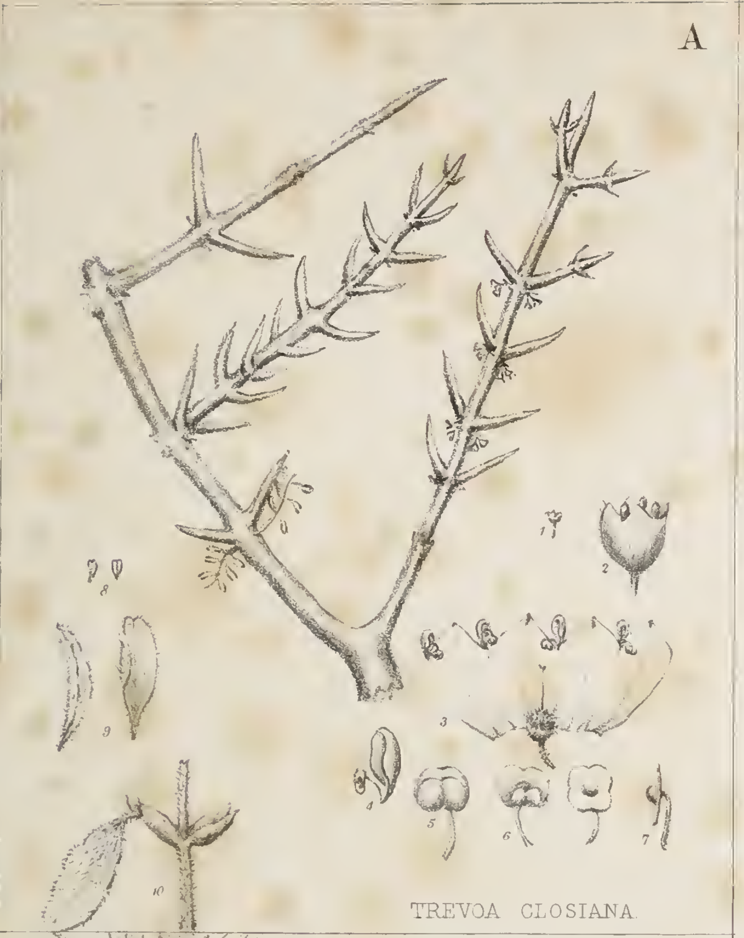
T. BERTEROANA.

T. WEDDELLIANA.

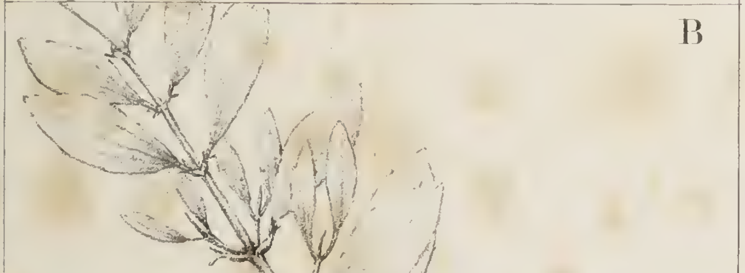
Miers.del

W. West imp.

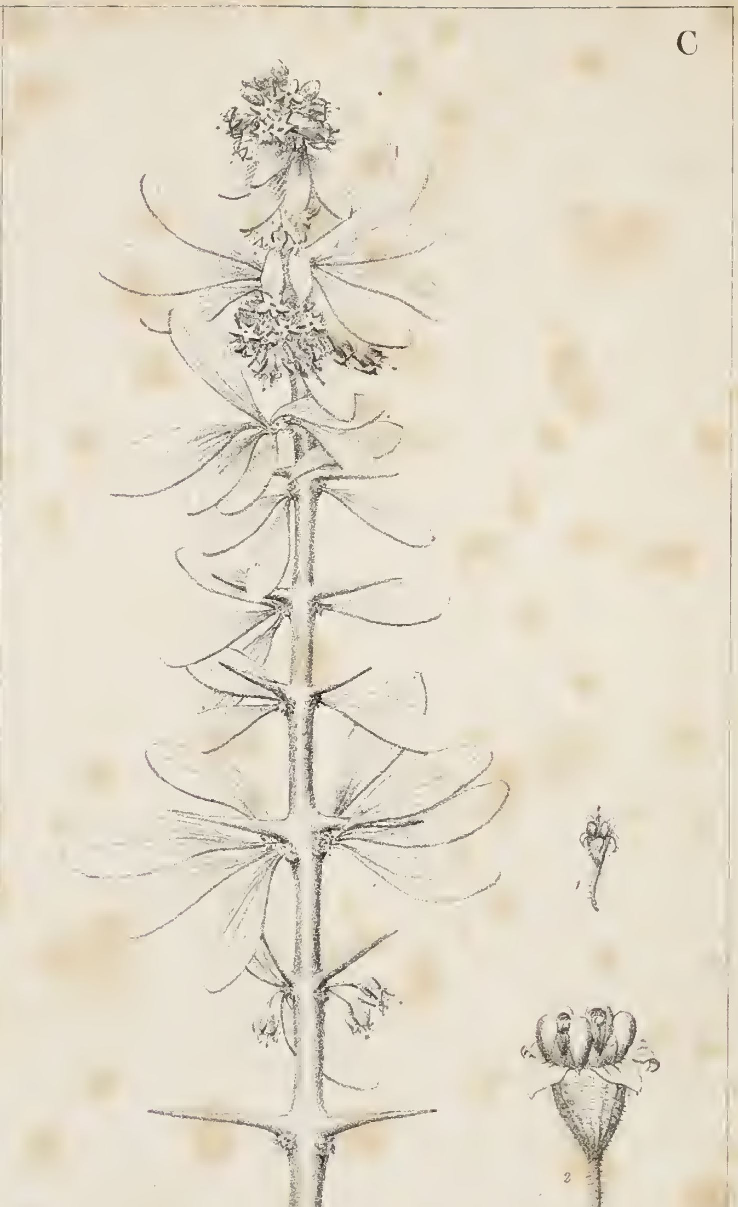
TREVOA.



TREVOA CLOSIANA.

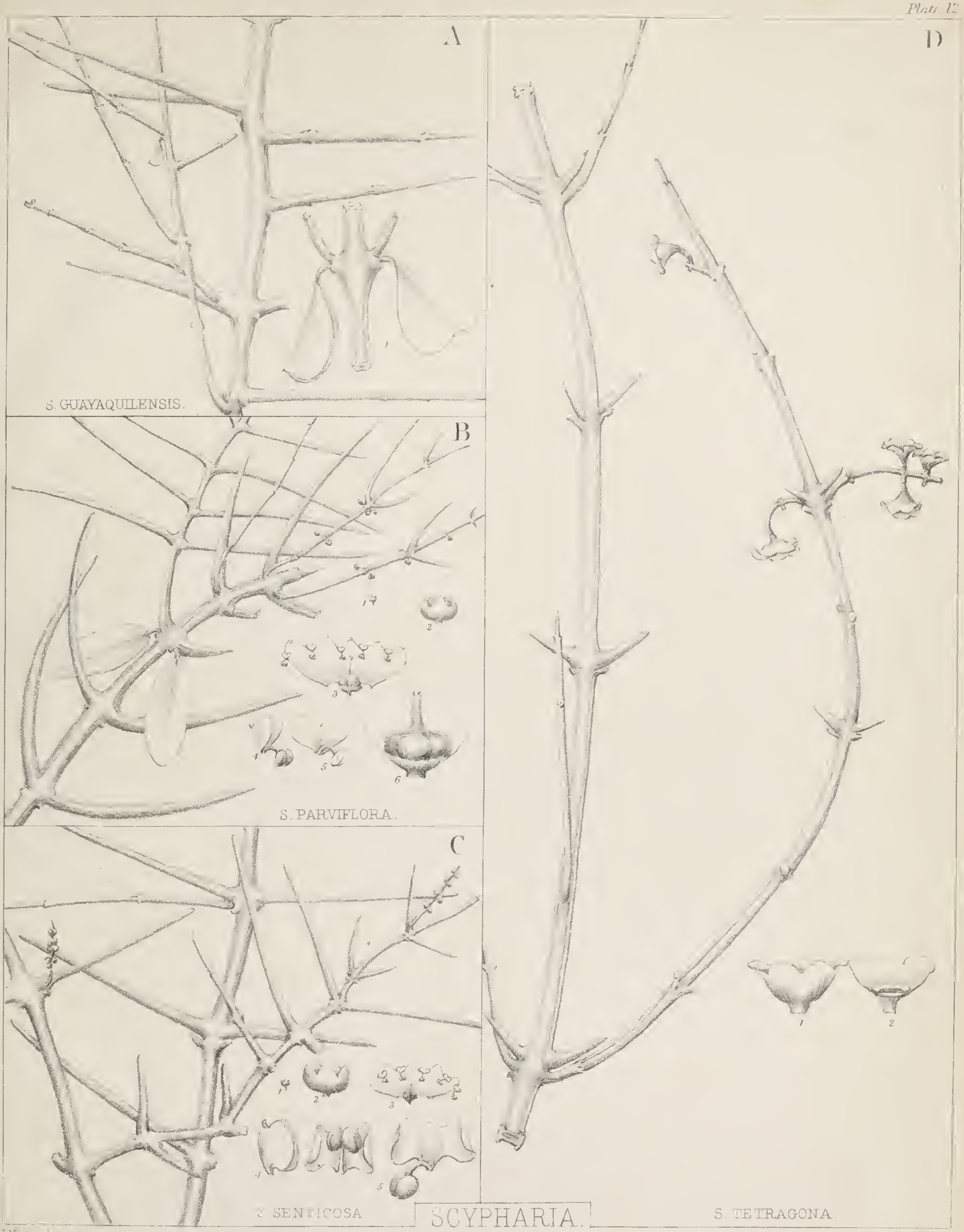


TALGUENEA MOLLIS



TALGUENEA COSTATA

J Miers del
W West imp



SCYPHARIA.

J Miers del.

[illegible] imp

13
25